may 1957

nlgi spokesman

journal of the national lubricating grease institute

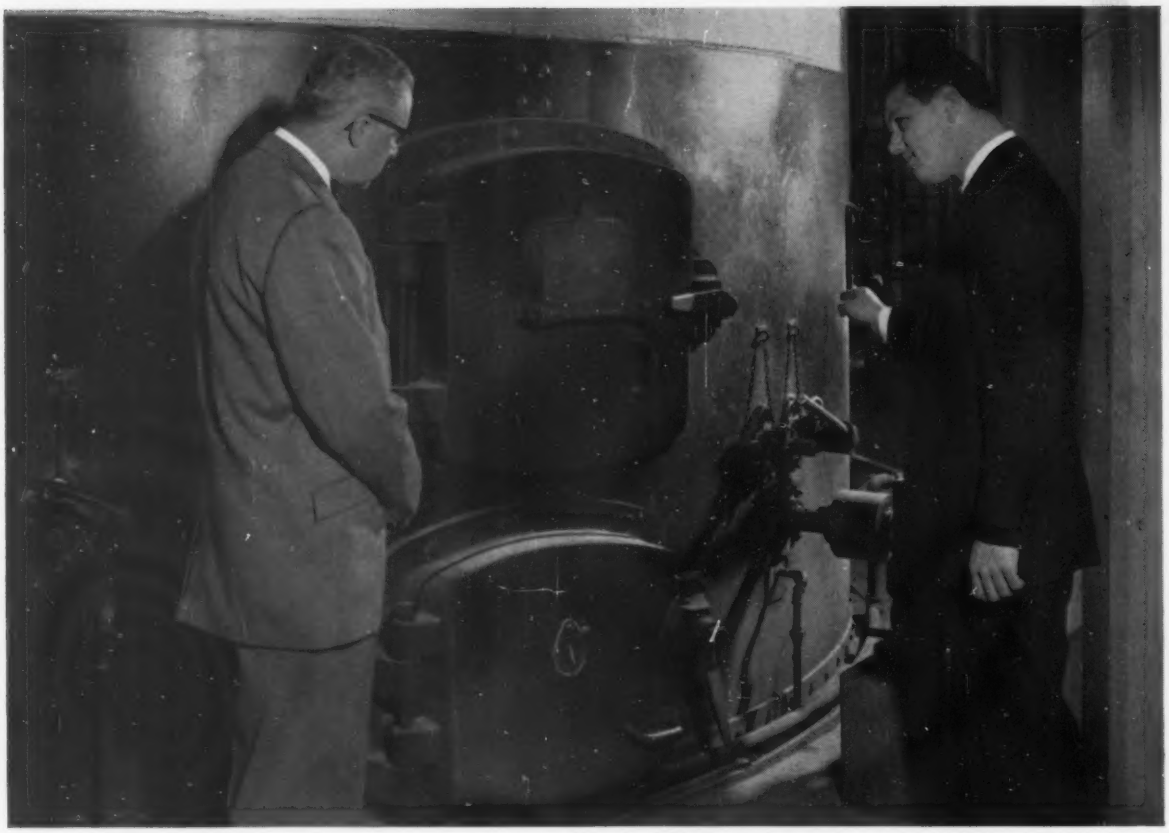
Progress Report—The Institute Movie
By J. W. LANE

Predicting High Temperature Performance of Lubricating Greases from Laboratory Bench Tests
By J. L. DREHER

Discussion of Dreher Presentation
By W. L. HAYNE, JR.

Evaluation of Grease Lubricated Bearings at High Rotative Speeds
By J. R. ROACH and T. B. JORDAN

The Service Station and Motorist Safety
By J. E. SIMONDS



ESTERSIL GREASE solves a bad leakage problem

If your best grease sometimes fails to satisfy a customer's toughest requirements, consider the advantages of using Du Pont Estersil GT (grease thickener). Actual performance proves estersil greases to be non-melting and resistant to water-thinning under the most severe operating conditions.

An engineering corporation, for example, encountered a tough grease-leakage problem in a large municipal incinerator. Ordinary lubricants failed to stand up under the high temperatures, estimated at 500 to 600 degrees F., and the ash gates frequently had to be disassembled and cleaned.

No washout with estersil grease

The engineers tried a number of standard-base lubricants on the ash gate sleeves. But in every case severe oil leakage occurred, leaving a hard, black residue. The cleanings required to keep the sleeves free from this residue led to considerable expensive downtime.

Then an estersil grease was tried. It was found to have just the right properties for this application: unusually high thermal stability and resistance to leakage. The problem was solved.

Grease easy to make . . . and it's stable

A milling operation is all that is required to manufacture an estersil grease. And when you supply your customers with this lubricant, you can be sure they get a product with all-around stability. In addition to its thermal stability, an estersil-based grease has excellent shear and oxidation stability. It shows exceptional resistance to extreme temperatures, water-washout and prolonged mechanical working. It is practically as stable as its base oils, needing no antioxidants under most service conditions.

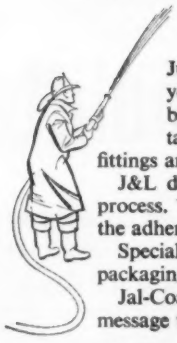
Du Pont Estersil GT is available in commercial quantities. Write us for samples and additional technical information.

DU PONT
REG. U.S. PAT. OFF.
Better Things for Better Living
. . . through Chemistry

Petroleum Chemicals

E. I. DU PONT DE NEMOURS & CO. (INC.) • Room 2420 Nemours Building • Wilmington 98, Delaware

PROTECTION is our business, too



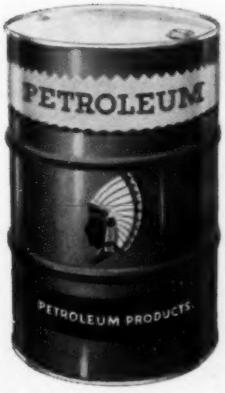
Just as valiant firemen are on around-the-clock alert to protect your life and property—J&L Steel Containers protect your products by providing dependable packaging that assures safety in transportation and storage. Their precise fabrication assures accuracy in all fittings and closures.

J&L drums and pails are chemically cleaned and dried by the JaLizing process. This assures a clean and dry, rust-inhibiting surface and increases the adherence and durability of decoration and interior lining.

Special protective interior linings are available to provide the best possible packaging for your products.

Jal-Coat, J&L's lithographing process, applies your trademark and sales message to the finished container . . . *no side seam touch-up is ever required.*

Plants located at Atlanta, Ga.; Bayonne, N. J.; Cleveland, Ohio; Kansas City, Kansas; Lancaster, Pa.; New Orleans, La.; Philadelphia, Pa.; Port Arthur, Texas; and Toledo, Ohio.



Jal-Coat, J&L's exclusive lithographing process, adds sales appeal to your products.

J&L STEEL

Jones & Laughlin
STEEL CORPORATION · PITTSBURGH

CONTAINER DIVISION
405 LEXINGTON AVE., NEW YORK 17, N.Y.

SANTOPOID 22-RI can stimulate a

There are new specifications for multipurpose gear lubes (and new lubrication recommendations) in the making—specifications you can meet simply by adding Santopoid 22-RI to oil. With it, you can produce a true multipurpose gear lube that has the finest corrosion protection available.

Extensive field evaluation during 1954, 1955, 1956 proves that a gear lubricant fortified with Santopoid 22-RI will meet both demands of:

1. Frequent shock loading of high-speed passenger car driving.

2. High-torque, extreme-pressure service in heavy vehicle hauling.

Now... regular drain and refill on *all* cars can come back. Important members of the automotive industry have stated that gear lubricants meeting the improved, new specifications would be satisfactory for service station refill for axles after 1,000-mile break-in.

NEW MARKET WAITING... The service station refill market for differential gear lubricants means a multimillion-dollar increase for gear lube manufacturers.

Field tests and commercial service performance over three years show that gear lubricants with Santopoid 22-RI provide satisfactory lubrication for both hypoid gears and worm drives . . . for both high-speed and high-torque service. Here's a single lubricant

multimillion-dollar market increase

that's best for both passenger cars and heavy-duty trucks.

You'll profit by adopting Santopoid 22-RI for your gear lubes now. Here's why:

1. With Santopoid 22-RI, you compound only *one* lubricant for both trucks and passenger cars.

2. You can market a single gear lubricant that you can depend on for multipurpose service.

3. You handle a *single* additive that can blend easily with *all* types of base oils.

4. Your gear lube will meet forthcoming new specifications that will set improved performance requirements qualifying a single lubricant as suitable for expanding commercial use.

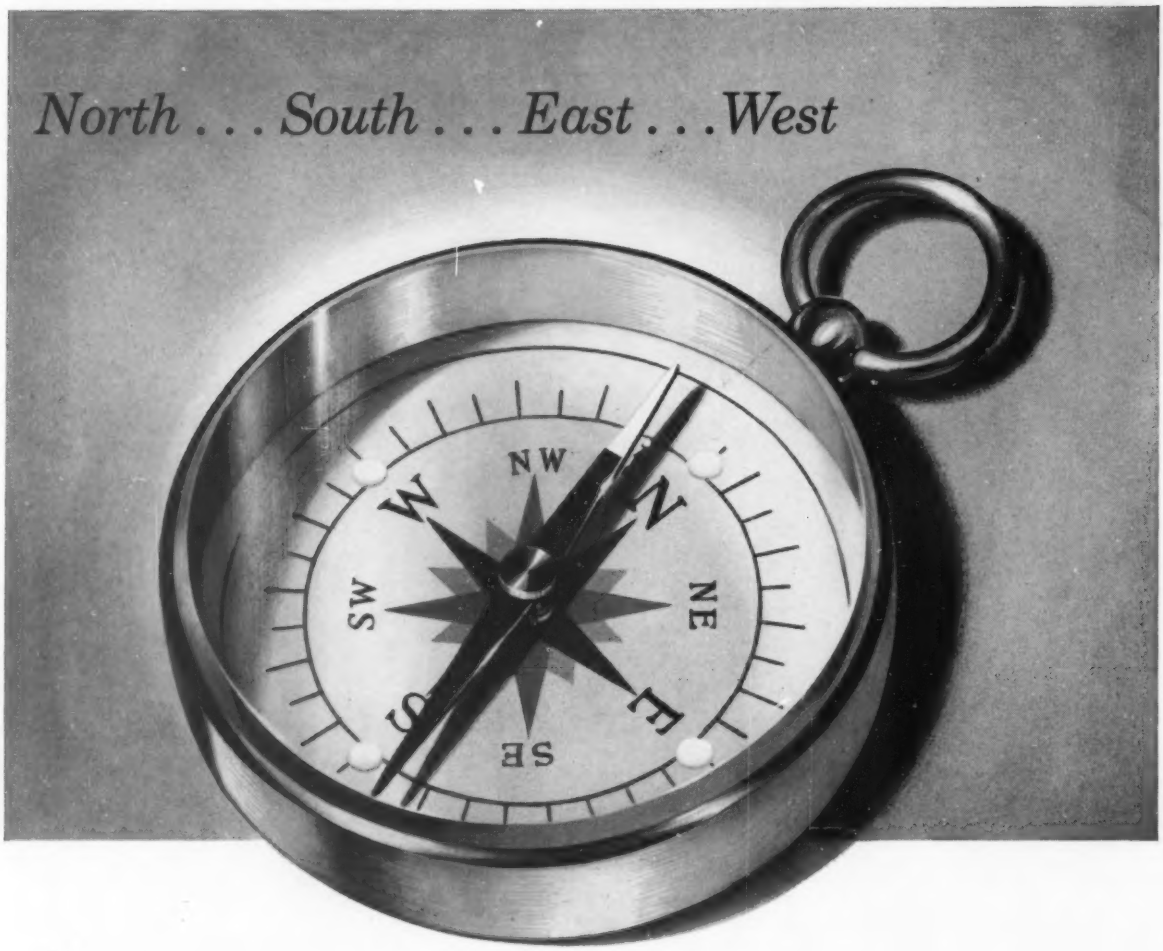
For further information or samples of Santopoid 22-RI, write today.

MONSANTO CHEMICAL COMPANY
Organic Chemicals Division
Department OA-72, St. Louis 1, Missouri

Santopoid: Reg. U.S. Pat. Off.

MONSANTO®

WHERE CREATIVE CHEMISTRY WORKS WONDERS FOR YOU



The performance and the name are the same around the world

MACHINERY MANUFACTURERS:

The performance of Shell Alvania Grease enjoyed by your domestic customers is available abroad. And this same uniformity applies to

SHELL TURBO OIL—gives anti-wear lubrication for utility, industrial and marine turbines

SHELL TELLUS OIL—lubricant and control fluid for complex hydraulic systems, and a complete line of other

SHELL INDUSTRIAL LUBRICANTS

Shell Alvania Grease, used world-wide as a multi-purpose lubricant, has an outstanding performance record in solving many of the toughest anti-friction bearing grease problems. Ideal for wet, humid applications (inhibited to prevent water corrosion), it lubricates under water-wet conditions which normally spell trouble.

Alvania* Grease has the added advantage of remaining plastic in sub-zero weather and stable under sustaining high temperatures. This one grease successfully replaces dozens of special lubricants in plant after plant . . . reason enough for its universal popularity. For complete information, write Shell Oil Company, 50 West 50th St., New York 20, N. Y., or 100 Bush St., San Francisco 6, Calif.

*Trademark

SHELL ALVANIA GREASE

A TRULY MULTI-PURPOSE LUBRICANT

SHELL

THE PRESIDENT'S PAGE

PROGRESS REPORT— THE INSTITUTE MOVIE

By J. W. LANE
NLGI
President

THIS IS AN excellent time to make a progress report on the NLGI moving picture, "Grease, the Magic Film," which is coming along in very fine fashion, being more than three-fourths completed. Your Motion Picture Committee is quite pleased with results to date and feels that this long-awaited promotion of the lubricating grease industry will receive wide acceptance when released. Several recent developments concerning prices, print ownership policies and practices, and the release data of prints are worth noting.

First, the greater indicated distribution has enabled us to reduce the cost of member purchasers. An initial print is now $600,

Continued, next page

SHOWN here are various filmed scenes from the new Institute film production.

THE PRESIDENT'S PAGE . . .

THE INSTITUTE MOVIE

. . . Continued

ANIMATION, application, laboratory scenes (top) and field shots (below) make up part of this instructive medium.

instead of the $800 quoted originally, while the price of a second print is $400. The price for a third and any additional prints is $200 each. Non-member prices, respectively, are $900, $700 and $300. These prices will return only a small part of the total cost of producing the film, most of the financing being furnished by NLGI as a service to its members and the industry generally.

The premiere of "Grease, the Magic Film" will be staged at the NLGI meeting in Chicago, at the Edgewater Beach Hotel, during the 1957 Annual Meeting. Because of the widespread interest in this training and public relations device, it is planned at this time that prints will be available for purchase at Chicago by interested members and guests not owning copies by that time. For six months following the premiere, the Institute will not have any public showings under its auspices, thus in effect giving purchasers an exclusive during that period, for exploitation in the manner they desire.

Of course, once the film has been completed, copies will be available for viewing by prospective purchasers at any time.

The field work yet to be done on this 26-minute color picture consists principally of a few more outdoor scenes. The principal photography has been completed, including many of the animation sequences showing the very beginnings of lubricating grease. I have had an opportunity to look at some "green" film, and was favorably impressed by what I saw. There are many striking scenes, of excellent color contrasts and composition.

The completed production will be quite extensive in scope and, for our specialized needs, should serve a need of long standing. I believe there will be quick acceptance of the film . . . first, by the lubricating grease industry and then by the general public, as owners of prints start to reap the results of promotion activities using this medium.

helping you improve your grease

with over 30 years of stearate experience

that's our business

Mallinckrodt's vast store of stearate knowledge pays off for you in two ways:

. . . specialized technical service to help you solve problems related to the application of stearates.

. . . a complete line of aluminum stearates that gives your greases the exact qualities demanded by your market.

high efficiency

Aluminum Stearate D-49 yields up to 25% more grease than conventional soaps and still maintains good stability. It also yields greases with higher dropping points than those generally obtained with other aluminum soaps.

moderate gelling

Aluminum Stearate D produces smooth, stable greases under a wide range of conditions . . . can be used with D-51 for higher yields.

SPECIAL STEARATES FOR SPECIAL GREASES

Let Mallinckrodt stearates and technical service help you improve *your* grease. *Write us about your needs today!*

Mallinckrodt®

MALLINCKRODT CHEMICAL WORKS

Mallinckrodt St., St. Louis 7, Mo. 72 Gold St., New York 8, N. Y.
CHICAGO • CINCINNATI • CLEVELAND • DETROIT • LOS ANGELES • PHILADELPHIA • SAN FRANCISCO
In Canada: MALLINCKRODT CHEMICAL WORKS LIMITED—MONTREAL • TORONTO
Manufacturers of Medicinal, Photographic, Analytical and Industrial Fine Chemicals

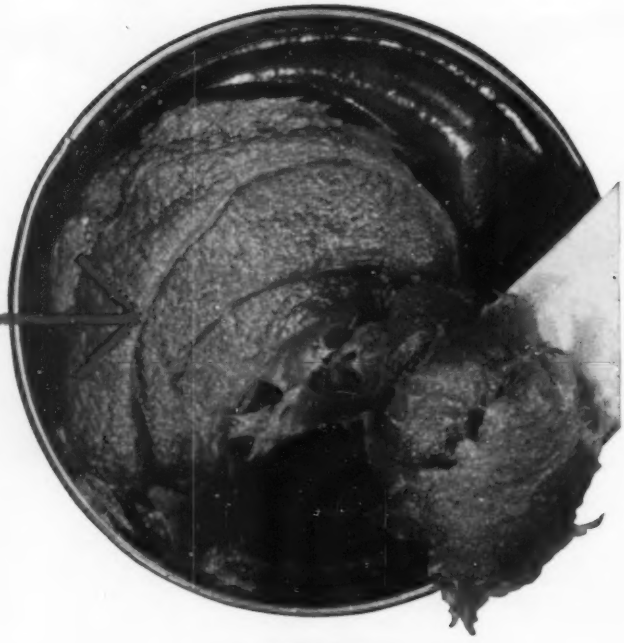
when you start with...

you have a fatty acid . . .
. . . made from marine oils
. . . 95.7% saturated
. . . containing no polyunsaturated acids
. . . composed largely of long chain (C_{20} and C_{22}) acids
. . . resistant to oxidation
. . . ideal for lime and soda based greases

SPECIFICATIONS

Titre	51 to 53°C
Acid Number	197 to 202
Iodine Value	6 maximum
Saponification Value	198 to 203
Average Molecular Weight	279 to 283
Specific Gravity	0.832
Color 5 ¼" Lovibond	Max. 25Y/2.5R

you end with a...
QUALITY GREASE



. . . a lubricating grease with superb workability.
. . . a grease that resists "bleeding".
. . . a grease that does not separate into soap and oil.
. . . a grease with excellent gel stability.
. . . a grease with water resistance.
. . . a uniform grease.

Hydrofol PRODUCTS

Hydrogenated and Distilled Fatty Acids and Stearic Acid . . . Hydrogenated Vegetable, Fish, Sperm Oil and Tallow . . . Hydrogenated Castor Oil . . . Stearyl, Cetyl, Oleyl Alcohol . . . Sperm Oils and Spermaceti . . . Behenic Acid . . . Erucic Acid . . . Hydroxystearic Acid . . . Olefins . . . Hydrocarbons.

Chemifats that put SELL into your products

WRITE FOR MORE INFORMATION

Gentlemen: Please send technical information on Hydrofol Acids 51 and other related Fatty Acids for the grease industry. Samples are available.

Name _____
Title _____
Company _____
Address _____
City _____ State _____

Archer-Daniels-Midland company
CHEMICAL PRODUCTS DIVISION
700 INVESTORS BUILDING • MINNEAPOLIS 2, MINNESOTA

nlgi spokesman

Volume XXI MAY, 1957 Number 2

Published Monthly by National Lubricating Grease Institute, T. W. MILLER, Editor; JOAN SWARTHOUT, Assistant Editor, 4638 J. C. Nichols Parkway, Kansas City 12, Missouri. Telephone: VAlentine 1-6771. 1 Year Subscription $2.50. 1 Year Subscription (Foreign), $4.00.

OFFICERS

President: J. W. LANE, Socony Mobil Oil Co., Inc., 150 East 42nd St., New York 17, N. Y.

Vice-President: R. CUBICCIOTTI, L. Sonneborn Sons, Inc., 300 Fourth Avenue, New York, N. Y.

Treasurer: A. J. DANIEL, Battenfeld Grease and Oil Corp., 3148 Roanoke Road, Kansas City, Mo.

Executive Secretary: T. W. MILLER, 4638 Nichols Parkway, Kansas City 12, Mo. VAlentine 1-6771.

DIRECTORS

W. W. ALBRIGHT, Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.

D. P. CLARK, Gulf Oil Corp., Gulf Building Pittsburgh, Pa.

R. CUBICCIOTTI, L. Sonneborn Sons, Inc., 300 Fourth Avenue, New York, N. Y.

A. J. DANIEL, Battenfeld Grease and Oil Corp., 3148 Roanoke Rd., Kansas City, Mo.

H. P. FERGUSON, Standard Oil Co. of Ohio, Midland Bldg., Cleveland 15, Ohio.

F. R. HART, Standard Oil Co. of California, 225 Bush Street, San Francisco, Calif.

H. L. HEMMINGWAY, The Pure Oil Co., 35 E. Wacker Drive, Chicago, Ill.

C. L. JOHNSON, Jesco Lubricants Co., P. O. Box 7331, North Kansas City, Mo.

GEORGE LANDIS, Atlantic Refining Co., 260 S. Broad Street, Philadelphia 1, Pa.

J. W. LANE, Socony Mobil Oil Co., Inc., 150 E. 42nd St., New York 17, N. Y.

H. A. MAYOR, JR., Southwest Grease and Oil Co., 220 W. Waterman, Wichita, Kans.

G. E. MERKLE, Fiske Brothers Refining Co., 129 Lockwood Avenue, Newark 5, N. J.

W. M. MURRAY, Kerr-McGee Oil Industries, Inc., Kerr-McGee Bldg., Okla. City, Okla.

G. A. OLSEN, Sunland Refining Corp., P. O. Box 1512, Fresno, Calif.

F. E. ROSENSTIEHL, The Texas Co., 135 East 42nd Street, New York 17, N. Y.

W. H. SAUNDERS, JR., International Lubricant Corp., P.O. Box 390, New Orleans, La.

J. V. STARR, Esso Standard Oil Co., 15 West 51st Street, New York 19, N. Y.

B. G. SYMON, Shell Oil Co., Inc., 50 West 50th, New York 20, N. Y.

IN THIS ISSUE

PREDICTING HIGH TEMPERATURE PERFORMANCE OF LUBRICATING GREASES FROM LABORATORY BENCH TESTS....13
by J. L. Dreher, California Research Corporation

DISCUSSION OF DREHER PRESENTATION....16
by W. L. Hayne, Standard Oil Company (Indiana)

EVALUATION OF GREASE LUBRICATED BEARINGS AT HIGH ROTATIVE SPEEDS....18
by J. R. Roach and T. B. Jordan, The Texas Company

THE SERVICE STATION AND MOTORIST SAFETY....24
by J. E. Simonds, Esso Standard Oil Company

FUTURE MEETINGS....31

PATENTS & DEVELOPMENTS....32

PEOPLE IN THE INDUSTRY....40

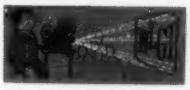
TECHNICAL COMMITTEE COLUMN....41

INDUSTRY NEWS....44

AMERICAN FLANGE & MANUFACTURING JOINS NLGI....52

GUIDEPOSTS....54

THE COVER



Featured on the cover are a few random shots from the animated, color motion picture titled "Grease the Magic Film."

The film will have it's premiere at the NLGI Annual Meeting in Chicago this October. More information, cost reduction and a progress report are given by President J. W. Lane on pages 7 and 8.

The NLGI SPOKESMAN is indexed by Industrial Arts Index and Chemical Abstracts. Microfilm copies are available through University Microfilm, Ann Arbor, Mich. The NLGI assumes no responsibility for the statements and opinions advanced by contributors to its publications. Views expressed in the editorials are those of the editors and do not necessarily represent the official position of the NLGI. Copyright 1957. National Lubricating Grease Institute.

Lithium-Base Multi-Purpose

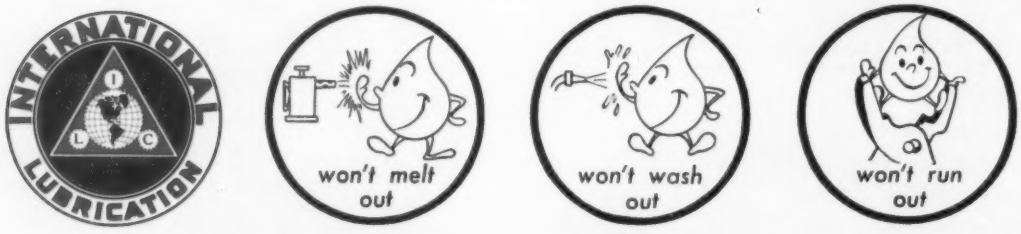
INLUCITE 21 OUTLASTS

ANY ORDINARY GREASE

Nine lives? That's what users say of INLUCITE 21, the unexcelled all-weather multi-purpose grease that lasts longer than every specialized grease it replaces.

This rugged moisture-resistant lubricant has proved its remarkable mechanical stability in the field by farm cooperatives, fleet superintendents, service station operators, other automotive and industrial users.

Let us give you full details.



INTERNATIONAL LUBRICANT CORP.

NEW ORLEANS, LOUISIANA

Manufacturers of Quality Lubricants • AVIATION • INDUSTRIAL • AUTOMOTIVE • MARINE

With Research Comes Quality, With Quality Comes Leadership

Predicting HIGH TEMPERATURE PERFORMANCE of Lubricating Greases

By J. L. DREHER, California Research Corporation

SET of thin film strips are removed from an oven in California Research lab. Screening greases for high temperature bearing tests is done with a static thin film spread uniformly with notched spatula on a strip of steel shim stock.

PETROLEUM RESEARCH laboratories across the nation are devoting more and more time to the development of high temperature lubricants. In the lubricating grease field, this is reflected in an ever increasing demand for bearing tests at elevated temperatures. Generally, the number of greases to be tested far exceeds the number of available test stands. Therefore, laboratory bench tests which can be used to screen experimental greases with assurance are important.

ASTM and Federal test methods for evaporation, separation, oxidation stability, dropping point, and work stability may be used as rough guides. However, the results of these tests cannot be used to predict with certainty the performance of a grease in high temperature bearing tests.

For instance, although a high rate of evaporation presages poor bearing performance, a low rate does not necessarily indicate good high temperature per-

NAVY high speed bearings are being assembled for testing after greases have been screened from thin film test.

formance. A grease with a high degree of oil separation will probably be unsatisfactory; on the other hand, a low degree of separation does not guarantee a satisfactory grease. The lack of correlation between either the ASTM oxidation stability test or the ASTM dropping point test and bearing tests is well recognized. While work stability may be generally a desirable property, it was shown at the ASTM Symposium on work stability held at Dallas in February 1955 that performance in service could not be predicted from laboratory work stability results. The papers presented at the symposium were published in the NLGI SPOKESMAN during the past year.

In screening greases for high temperature bearing tests at California Research corporation, we have had considerable success with a static thin film test conducted as follows: a film of grease 1/32-inch thick, ⅞-inch wide, and 2½ inches long is spread uniformly with a notched spatula on a strip of steel shim stock. The shim is then placed horizontally in an oven at the desired test temperature. At appropriate intervals, the grease sample is inspected for the retention of its greaselike properties. The inspection usually consists of rubbing a small portion of the grease between the fingers or working it with a spatula.

A set of samples ready to be placed in an oven is shown in Figure 1.

After being exposed to the selected temperature for some length of time, greases generally melt, separate, flake, or harden. Typical examples are shown in Figure 2.

The test is subjective because there is usually no distinct point at which a grease loses its greaselike characteristics. For this reason, it is advisable to have a reference grease of a similar type in any set of test

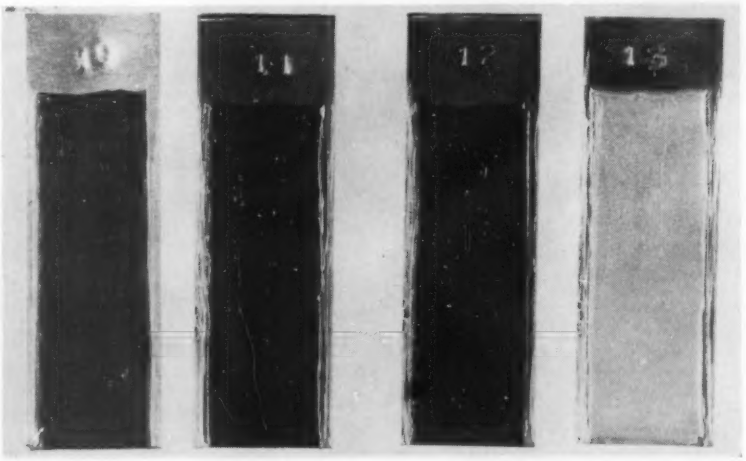


FIGURE 1 A set of thin film strips ready to be placed in an oven. After considerable exposure to the selected temperature, greases vary in change.

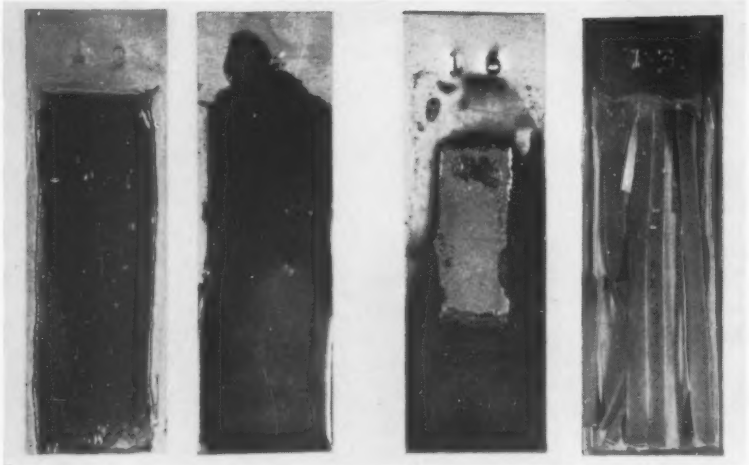


FIGURE 2 Four examples of typical types of grease behavior during thin film tests are left to right: hardening, melting, separation, flaking.

greases. The behavior of the experimental greases may then be compared to that of the reference grease.

The thin film test is useful in screening experimental greases for the following purposes:

1. Selection of oxidation inhibitors
2. Selection of oil stocks
3. Evaluation of manufacturing problems

One of the most difficult problems in the development of a high temperature grease is the selection of the optimum concentration of an oxidation inhibitor. Many products are available, and new materials are continually being discovered. The ranking of each potential material over a range of concentrations would be an insurmountable task if it had to be done in bearing tests.

Table I shows the effectiveness of the thin film test in screening greases for the Navy high speed bearing test.* In a lithium-calcium base grease, Inhibitor B was found to be substantially superior to Inhibitor A in the thin film test. This was confirmed by the bearing tests. The screening test indicated that in a sodium base grease inhibitor C is somewhat superior to inhibitor D and that both are markedly superior to the uninhibited grease. Bearing tests confirmed the results.

TABLE I

Use of Thin Film Test to Select Oxidation Inhibitors

Grease Base	*Lithium-Calcium*		*Sodium*		
Inhibitor	*A*	*B*	*None*	*C*	*D*
Thin Film Life (days)					
250° F	6	14	—	—	—
300° F	—	—	16	40	35
Bearing Life (hours)					
250° F	216	1032	—	—	—
300° F	—	—	—	1300	982
350° F	—	—	65	393	—

The use of the thin film test for the selection of the oil component of a high temperature grease is illustrated in Table II. Oil stock number 1 is a synthetic fluid potentially capable of being used in a MIL-G-3278A grease. It was compared with oil stock number 2 in lithium-calcium base greases containing the same oxidation inhibitors. Both the thin film life and the bearing life show that oil stock number 1 is inferior to oil stock number 2.

When a new process was developed for the manufacture of two antifriction bearing greases at Standard Oil Company of California, the resultant products were evaluated in the thin film test. The results shown in Table III indicate that the high temperature properties of the greases are substantially improved. Subsequent bearing tests confirmed the thin film data.

TABLE II

Use of Thin Film Test for Selection of Oil Stocks

Grease Base	*Lithium-Calcium*	
Oil Stock	No. 1	No. 2
Thin Film Life at 250° F (days)	14	24
Bearing Life at 250° F (hours)	492	1173

TABLE III

Use of Thin Film Test to Evaluate Manufacturing Processes

Grease	*No. 1*		*No. 2*	
Procedure	*Old*	*New*	*Old*	*New*
Thin Film Life at 250° F (days)	15	20	14	21
Bearing Life at 250° F (hours)	715	1011	1032	1817

These examples show that a simple, qualitative laboratory bench test can be used effectively in screening experimental high temperature greases. At present, the test must be confined to comparing greases of a similar type. Preliminary studies indicate that the test can be improved by mixing iron and copper powders into the test greases to promote oxidation. With further study, it is hoped that the thin film test will be perfected so that a reliable correlation can be established between dissimilar types of greases. ■

*Federal test method 331.1

About the Author

J. L. Dreher *is group supervisor of the grease research and development laboratory of California Research corporation. He joined the company in* 1945. *Dreher obtained his A.B. degree in chemistry from the University of California in* 1935 *and began working for General Petroleum corporation. In* 1943 *he joined the Metallurgical Laboratories (Manhattan Project), Chicago University, and was then employed by Hanford engineering works (a subsidiary of E. I. DuPont) in* 1944. *Dreher is a member of ACS, ASLE and American Association for the Advancement of Science.*

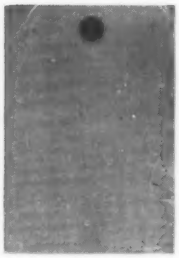


Fig. 1
No. 1

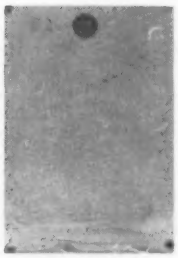
Fig. 2
No. 1

No. 2

No. 2

No. 3

No. 3



No. 4

No. 4

No. 5

No. 5

Discussion of Dreher Article

By W. L. Hayne, Jr.
Standard Oil Company (Indiana)

RAPID SCREENING TESTS for evaluating greases are certainly helpful for efficient product development. Mr. Dreher has described a simple and convenient method for qualitatively appraising high-temperature resistance.

Oven tests of grease on steel panels have also been used for the same purpose in our laboratory with much success. Grease is weighed onto a two-inch by three-inch steel panel and spread uniformly to give a film of nearly the same thickness as used by Mr. Dreher. Thicker and thinner films were tried and found to be less useful. The panels are placed either horizontally or obliquely in an oven maintained at the desired test temperature of 300°, 350°, or 400° F. Inspection is made essentially as described by the speaker.

The most satisfactory temperature for our evaluation has been 350° F. Figures 1 and 2 show thirteen panels representing a variety of high-temperature greases before and after testing in a horizontal position for five days. Only panels 1 and 2 had a grease film that might be considered to retain some service life. Failure of the grease on most of the panels is clearly shown by the dried and cracked appearance; these films are normally hard and do not adhere to the panels. Although the behavior is not apparent from the pictures, the grease on panel 5 was excessively heavy and the grease on panel 12 was semifluid.

In addition to being of value in selecting oils and evaluating oxidation inhibitors, panel tests also aid in the study of thickener characteristics. Both leakage and loss of mechanical stability can be determined. Leakage tests are conducted by placing the panel obliquely in a tared glass beaker in the oven. Flow of grease and oil into the beaker can be readily observed; structural changes as well as leakage can often be distinguished. Mechanical stability after exposure to high temperatures can be measured by use of larger panels to provide sufficient grease for ¼-scale cone penetrations.

Experience in our laboratory fully supports Mr. Dreher's conclusion that panel tests help to select high-temperature greases. The panel method simplifies screening tests and further work should extend the use of it.

Fig. 1

No. 6

Fig. 2

No. 6

Fig. 1

No. 10

Fig. 2

No. 10

No. 7

No. 7

No. 11

No. 11

No. 8

No. 8

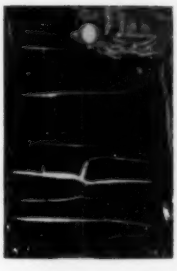
No. 12

No. 12

No. 9

No. 9

No. 13



No. 13

About the Author

WILBUR L. HAYNE, JR. *is a native of Martins Ferry, Ohio. He received his B. S. degree in chemical engineering from the University of Louisville in* 1947 *and an M. S. degree in chemical engineering at the same time. Hayne had interrupted his work at the university to serve with the U. S. Navy as an officer aboard a submarine from* 1943 *to* 1946. *He joined the research department of Standard Oil company (Indiana) in January of* 1948, *where he is presently. Hayne is a member of Sigma Tau, Theta Chi Delta, AIChE, ASLE and ACS.*

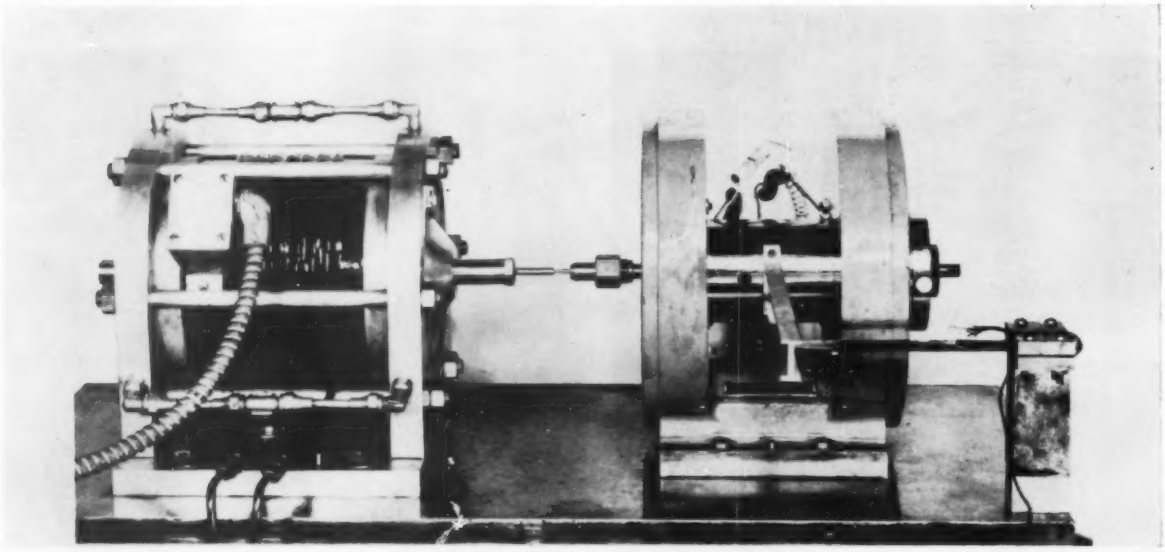
By J. R. Roach
and T. B. Jordan

The Texas Company

THE TEXAS COMPANY was an early entrant in the field of the grease lubrication of high speed ball bearings. An active program was started about 10 years ago and is continuing at the present time. Some of the equipment and test conditions used during the course of this work will be discussed and data showing the effect of several of the more important variables on performance of greases in high speed ball bearings will be presented.

The major portion of our high speed testing program has utilized 20 mm. bore bearings operated at 35,000 r.p.m. Figure 1 shows the first piece of equipment used in this work. This unit is still in operation. The test unit is mounted in a cradle and is coupled directly to the drive motor. The coupling consists of an Erickson collet and a necked-down shaft. This

FIGURE 1 First piece of equipment used in Texas company's high speed testing program. The unit is still in operation.



SUMMARY

The Texas Company has been studying the grease lubrication of high speed ball bearings for a number of years. The major portion of the program has utilized 20 mm. bore bearings operated at 35,000 r.p.m. Direct motor-driven and belt-driven high speed test units are described in detail. The former is generally operated in eight hour cycles with 80 lb. thrust load applied to the bearings. The belt driven unit is operated with 20 to 50 lb. thrust load and 35 lb. radial load on a more continuous basis that more closely simulates service conditions. The cyclic procedure, because of the greater thrust load involved, is more severe than the simulated service test and used primarily for screening.

The performance life of grease lubricated bearings lowers with increase in DN Value (bore diameter in mm. x speed in r.p.m.) and in temperature. The effect of metallic versus non-metallic bearing retainers and of outer race-riding versus inner race-riding retainers on performance life is illustrated.

With care in the selection of greases and bearings, with proper attention to bearing clearances, tolerances, and fits and with trained personnel who realize the importance of cleanliness and attention to detail in the assembly of the units, grease lubrication of bearings at DN Values of 1,000,000 or higher is feasible.

shaft ruptures when the resistance offered by the test bearings becomes excessive, thus preventing damage to the drive motor. The power to drive the test spindle is derived from a 7 hp. 600 cycle induction motor. The high frequency current required is obtained from a 600 cycle 25 KVA generator driven by a 30 hp. 230 volt DC motor. The high speed 7 hp. motor is fitted with plain bearings which are lubricated by oil circulation. Heat generated in the motor is dissipated by circulating water through a copper coil wrapped around the exterior. The spindle housing is mounted on rollers in the cradle and is free to rotate. Thus the bearing torque can be measured by means of a torque arm and strain gauges. This unit has been very reliable and trouble-free during its approximately ten years of operation.

The disassembled spindle is shown in Figure 2. All of the parts are sturdy which aids in preventing distortion of the test unit by heat or stress. The bearing shaft is over an inch in diameter and less than four inches between bearing seats which assures good stability. The shaft is dynamically balanced and the bearing seats are chrome-plated to reduce wear when pressing bearings on and off. Thrust load is applied to the bearings by means of nitrogen pressure through bellows "A" shown mounted in the end plate on the right. The load is applied directly to the outer race of bearing "B" by means of thrust plate "C" and thrust ring "D." Bearing "B" is mounted in the bearing sleeve "E" and is free to move laterally so thrust load is transmitted through the shaft to bearing "F" on the left, thus both bearings operate with the same thrust load. No radial load is applied to the bearings. Bearing temperatures are measured at the outer race by means of thermocouples inserted through the housing. The unit is easy to assemble, no special tools or equip-

EVALUATION OF GREASE LUBRICATED BEARINGS AT HIGH ROTATIVE SPEEDS

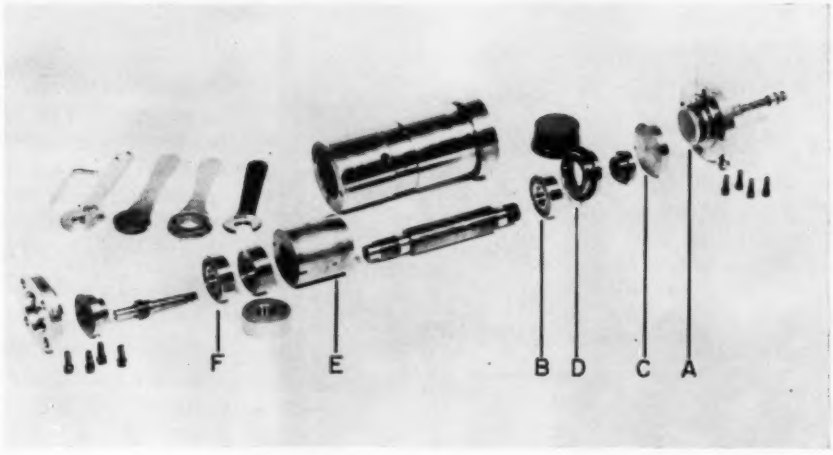


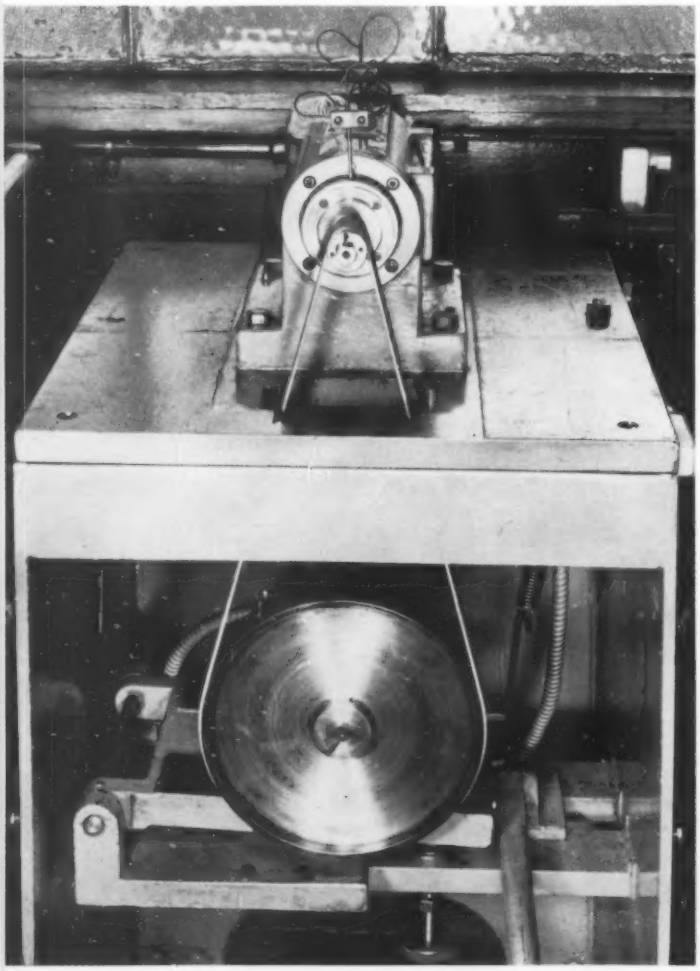
FIGURE 2 Disassembled spindle — thrust load is applied through belows A.

ment being required. The assembly is compact and has no large rotating parts; therefore, it has not been necessary to rebalance the equipment. Super precision ABEC grade Number 7 bearings equipped with non-metallic retainers are generally used with this spindle.

One of the outstanding features of this unit is its flexibility. It can be operated at speeds up to 36,000 r.p.m. and at thrust loads up to 200 pounds. No provision has been made to apply heat to the bearings or for controlling bearing temperatures, but this could be done without much difficulty.

One drawback to this unit as presently set up is the large amount of costly and bulky equipment needed to supply current to and provide lubrication of the drive motor. This auxiliary equipment occupies about 65 square feet of floor space, whereas the test spindle and drive motor occupy only about 6 square feet. At the time this unit was installed, this appeared to be the most practical method of obtaining high rotative speeds. At the present time, turbines are developed to the point where they appear to be more practical than the high cycle motor for this type of service.

FIGURE 3 High rotative test unit consists of grinding spindle belt-driven at 35,000 rpm with ¾ h.p. motor.



This high speed assembly is used for the evaluation of both greases and bearings. The unit is run for eight 8-hr. cycles or to prior failure at 35,000 r.p.m. with 80 lb. thrust load applied to the bearings. The bearings are normally packed full of grease and allowed to purge themselves of excess grease during the run. Bearing spacers and end plates are recessed 1/16 of an inch to contain the grease forced out of the bearings. Bearing temperatures are not controlled but usually run at 200°F. or higher due to internal friction.

Another unit used for testing greases at high rotative speeds and which is less elaborate than the one previously described is shown in Figure 3. It consists of a modified grinding spindle belt-driven at 35,000 r.p.m. with a 3500 r.p.m. ¾ hp. electric motor. The frame which contains the spindle housing is fitted with cartridge type heaters to permit operation of the test bearing at elevated temperatures if desired. A radial load of about 35 pounds is applied through the belt and is carried almost entirely by the front bearing; thrust load is applied by means of springs and can be varied as desired. Generally thrust loads of the order of 20 to 50 lb. are used.

Figure 4, showing the disassembled unit, illustrates one means of applying thrust using a spring holder and a series of small springs. A single coil spring which fits over the shaft has also been used with satisfactory results. The front bearing is free to move laterally in the housing, thereby applying the thrust load equally to both bearings.

This unit, which is fitted with 20 mm. bore bearings, is sturdy and easy to assemble. Its chief advantage is its simplicity and relatively low equipment cost. It is quite versatile in that both temperature and load can be varied over wide ranges. A disadvantage is that the unit can operate only at one speed with a given set of pulleys. This means the unit has to be taken to top speed immediately without allowing for a break-in period at a lower speed. The shaft is also quite long in this unit, about 10 inches between bearing seats. It is felt that stability would be improved and more consistent results obtained with a shorter shaft. In designing a new unit consideration would be given to this point.

This belt-driven spindle has been used mainly for long-time tests under simulated service conditions in contrast to the accelerated short-time tests run on the direct motor-driven unit described earlier. Generally

TABLE I
Effect of Load On Bearing Performance

	Endurance Test	*Simulated Service Test*
Speed, r.p.m.	35,000	35,000
Thrust load, lb.	80	20
Radial load, lb.	—	35
Bearing Temp., °F.	200-250	120-150
	Hours to Failure	
Grease A	64	5000+
Grease B	44	5000+
Grease C	8	1222
Grease D	17	797

it is operated at 35,000 r.p.m., 20 lb. thrust load, and 35 lb. radial load with no external heat applied. Bearing temperatures ranged from 120 to 150°F. under these conditions. Operation is continuous except for a 40 hr. shutdown period each weekend. A full pack of grease is used in the test bearings.

fact that two of the greases tested gave performance in excess of 5000 hours is evidence that grease is a suitable lubricant for use in bearings operating at a DN value of 700,000.

A limited study has been carried out at speeds higher than those discussed above. One phase utilized two small air turbines fitted with 10 mm. bore ball bearings operated at 65,000 r.p.m. and 250°F. with about a 5 lb. thrust load. Reproducibility was a problem with these units but performance in excess of 500 hours was obtained with two different greases. Another air turbine fitted with 20 mm. bore ball bearings was operated at 50,000 r.p.m. and ambient temperature. Results obtained to date indicate that grease is a satisfactory lubricant for use at these higher speeds.

During the course of our work in the field of high speed bearing lubrication, a large amount of data have been accumulated. Time does not permit a comprehensive review of these data but a few of the more

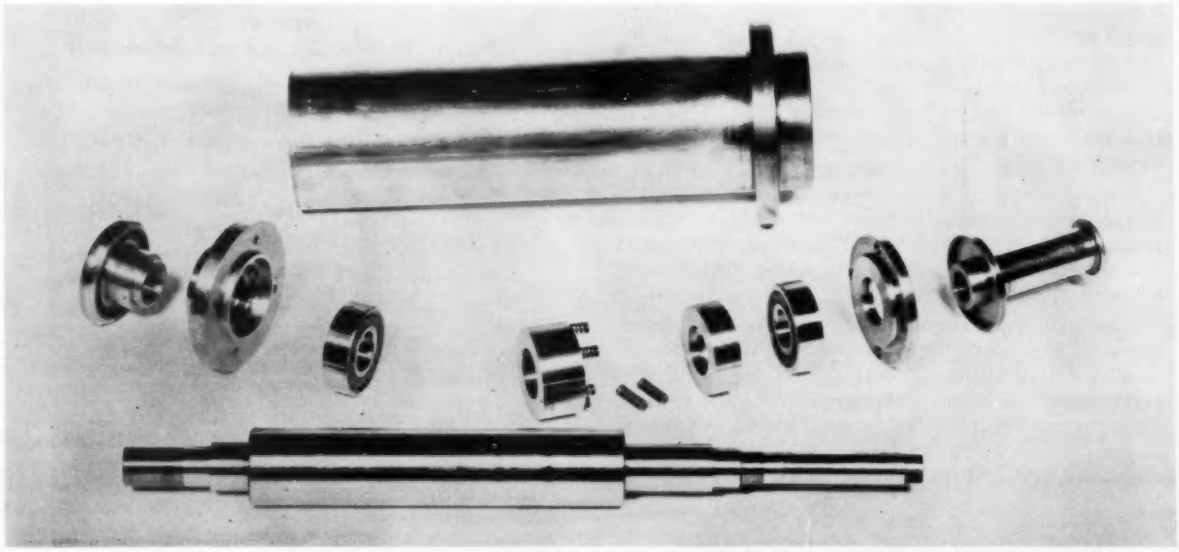


FIGURE 4 Disassembled unit showing one means of applying thrust using a spring holder and series of small springs.

As shown in Table I, there appears to be a fair correlation between the results obtained with the heavily loaded endurance test discussed previously and with the simulated service test conducted in the belt-driven unit. The 80 lb. thrust load represents a much more severe condition than the combined 20 lb. thrust load and 35 lb. radial load. The data obtained in the test using 80 lb. thrust load can be used to predict performance under the milder conditions and thus eliminate the necessity for the long-time simulated service tests. The interesting points will be discussed briefly.

One phase of the work concerned the effect of speed on performance life of grease-packed bearings. A series of tests were run at 300°F. with 20 lb. thrust applied to the bearings. Data obtained are shown in Table II.

These data were obtained with 20 mm. bore ball bearings except for the value under low speed conditions on grease "G" which was made in a 50 mm. bore bearing. Super precision ABEC grade 7 bearings

About the Authors

JAMES R. ROACH *is a chemist in the grease research department at the Texaco Research Center, Beacon, New York. Roach is a native of Montana and received his B. S. degree in chemistry from Montana State College in* 1947. *He joined the Texas company shortly after his graduation and and has been with them since that time.*

T. BURTON JORDON, *a native of South Dakota, received his early education at Hudson and Highmore, S. D. He majored in chemistry at the University of South Dakota, receiving a B. A. degree in* 1934 *and an M. A. in* 1937. *He served as assistant state chemist in the South Dakota state chemical laboratory from* 1934 *to* 1940 *when he joined the Texas company at Port Arthur, Texas as an analytical chemist. Since* 1941 *Jordan has been engaged in research on greases and on gear lubricants at Port Arthur Texas and at the Texaco Research Center at Beacon, New York.*

with non-metallic retainers were used for the high speed tests whereas ABEC grade 3 bearings with the ball-controlled steel ribbon-type retainers were used at the lower speeds. Although the differences in bearings represent a secondary variable, it is still evident that there is a marked reduction in bearing life with increased speed.

Bearing operating temperature is also an important factor in high speed performance. For example, a grease that ran for 500 to 600 hours at 300°F. in a bearing operating at 35,000 r.p.m. had a performance life of only 100-125 hr. at 350°F.

Another important consideration in the grease lubrication of high speed bearings is bearing design. In our work we have had occasion to use bearings with several types of ball retainers. Some effects of this variable on operating life at 35,000 r.p.m. and ambient temperatures with 80 lb. thrust load applied to the bearing are shown in Table III.

TABLE II

Effect of Speed on Bearing Life at 300°F.

Grease	*DN Value*	*Hours to Failure*
E	200,000	911
E	700,000	63
F	200,000	1055
F	700,000	48
G	85,000	5386
G	700,000	500-600

These data clearly show that for grease lubricated high speed bearings the outer race riding retainer type is superior to those with the retainer piloted on the balls or on the inner race. There are undoubtedly

TABLE III

Effect of Bearing Design on Performance

Test conditions—35,000 r.p.m., ambient temperature, 80 lb. thrust load

A. BEARINGS WITH NON-METALLIC RETAINERS

Bearing Type	*Hours to Failure*
Outer Race Riding Retainer	579
Inner Race Riding Retainer	250-300

B. BEARINGS WITH METALLIC RETAINERS

Bearing Type	*Hours to Failure*
Outer Race Riding Retainer	64+
Ball Riding Retainer	8

other design features which affect performance but we have not attempted an extensive investigation along this line.

It has been our experience that test results will show more scatter as speed is increased. At 35,000 r.p.m. deviations on duplicate tests frequently exceed 20 per cent and deviations as high as 50 per cent are not uncommon. Special care must be taken to assure that test methods are closely adhered to and that test units are assembled correctly and carefully. Bearing fits, clearances, and tolerance are known to be important in high speed testing. It is our practice to follow the bearing manufacturer's recommendations closely on these points. Cleanliness of lubricants, parts and working area is extremely important. A well-trained and experienced operator is needed if satisfactory results are to be obtained. If the above points are watched and a proper selection of lubricants and bearings is made, we believe that grease lubrication of bearings is feasible at DN values of 1,000,000 or higher. ■

Now Available . . .

nlgi spokesman

VOLUME XX

Complete April, 1956-March, 1957

More Than 30 Technical Articles Presented

of relation of relaxation theory to some properties of lubricants • fibers, forces and flow • use of arogels for examining structure of lubricating grease thickeners • inorganic thickeners, their use in grease manufacture • service requirements for multipurpose automotive greases • taking the confusion out of wheel bearing lubrication • lubrication of farm machinery • corrosion inhibited automotive greases • automotive greases and chassis lubrication • low temperature operation of aircraft accessories • current problems in grease lubrication of ball bearings • high temperature ultra high speed grease lubrication • centralized chassis lubrication • a critical look at chassis lubricants • new synthetic thickener

Sturdy green book binding with handsome gold lettering . . . a valuable and lasting addition to your reference library.

NLGI Member Price—$7.00*

Non-Member Price—$10.00*

*Plus Postage

Enter my order for a copy of Bound Volume 20 of THE NLGI SPOKESMAN.

I enclose { Check / Company Purchase Order

Name_____

Company_____

Street_____

City_____

State_____

Mail this coupon to

NATIONAL LUBRICATING GREASE INSTITUTE

4638 J. C. Nichols Parkway, Kansas City 12, Missouri

By J. E. Simonds

Esso Standard Oil Company

The Service Station and Motorist Safety

TO GET PEOPLE to pay you money for some service you render usually takes salesmanship—doesn't it? In fact, whenever you benefit from the actions of people—whenever you yourself benefit from the actions of people—salesmanship has somehow been brought to bear as an influence over those actions. Indeed, I suggest that to cause people to act on an idea of yours, for their own benefit, and at no cost to them, also requires real salesmanship.

Safeguarding the motorist against the hazards of his machine, the road and his own behavior, in my opinion, most certainly depends upon good salesmanship.

"The Service Station And Motorist Safety" entitles what I have to say because I am almost fanatical in my belief that in the service station environment good safety salesmanship finds its most frequent opportunity for effective use.

The very act of lubricating a car, changing crankcase oil, or transmission and differential lubricant—almost any service—is essential to the motorist's safety. I think it is essential not because, as you so well know, it provides the obvious technical and mechanical values of properly and consistently maintaining the friction-free condition of automotive equipment—but also because such acts are opportunities to observe—opportunities to sell—opportunities to sell safety.

Continued on page 26

Symbols of Service

. . . trends ahead in industrial applications for lithium

LCA

LITHIUM CORPORATION OF AMERICA, INC.

2575 RAND TOWER, MINNEAPOLIS 2, MINN.

PROCESSORS OF LITHIUM METAL • METAL DISPERSIONS
METAL DERIVATIVES: Amide • Hydride
SALTS: Bromide • Carbonate • Chloride • Hydroxide • Nitrate
SPECIAL COMPOUNDS: Aluminate • Borate • Borosilicate • Cobaltite • Manganite
Molybdate • Silicate • Titanate • Zirconate • Zirconium Silicate

BRANCH SALES OFFICES: New York • Chicago • Bessemer City, N. C.
MINES: Keystone, Custer, Hill City, South Dakota • Bessemer City, N. C.
Cat Lake, Manitoba • Amos Area, Quebec
PLANTS: St. Louis Park, Minnesota • Bessemer City, N. C.
RESEARCH LABORATORY: St. Louis Park, Minnesota

IN performing such services as lubrication jobs the dealer who recognizes safety as a real buying motive will check the tire to see that there isn't too much grease.

Now, salesmanship doesn't exist without salesmen. And because I am a training man, I believe that salesmen are not born, they are made. They are trained—formally or through experience—to be salesmen. In promoting the safety of motorists, I think of a team of at least two salesmen. First, the sales representative of an oil company, and then the man who lubricates the motorist's automobile.

One of these people, the oil company salesman, carries with him the ideas and policies of his employer, and the other, the service station dealer, places those ideas and many of his own into effect in the business he's conducting for himself.

If you will permit me, for the sake of discussion, to give these two fellows adequate motivation, sincerity and enthusiasm (qualities which unfortunately are missing in some very small percentage of the people engaged in this business) I will tell you why I think they strive to succeed.

Profit, of course, is a large part of the answer. But the oil company salesman covering dealer accounts must guide his dealers in practices known to succeed if he is to help them clear their shelves, empty their tanks and lubricating equipment so that more petroleum product can be sold through those accounts.

The salesman must do these things and do them well if he is to make a living at his job. He must do these things if he is to avoid complaints from dissatisfied users of petroleum product, the car owners, and dissatisfied—even bankrupt—dealers.

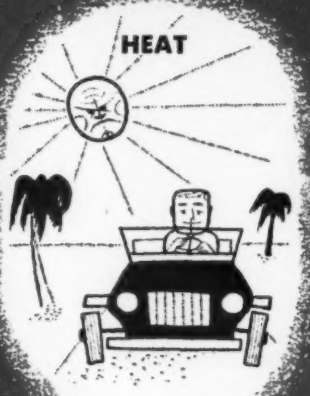
The dealers themselves, although they are quite independent in their choice, respond to this kind of salesmanship if they are to maintain the confidence and dependency of their motorist customers and the good business which provides income for good living and acceptable social status.

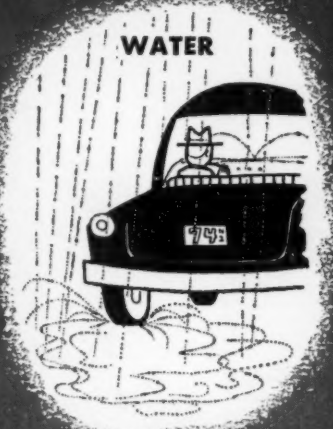
In service station salesmanship dealers are taught and they very quickly prove for themselves, that "safety"—the desire for safety—is a real buying motive of the motorist, and expresses "safety" as a benefit the motorist obtains in many of the products and services he offers for sale. Again, because of the act of lubricating a car or giving any of the other services which provide the dealer with ideal opportunity to observe, he is in a position to capitalize on this buying motive.

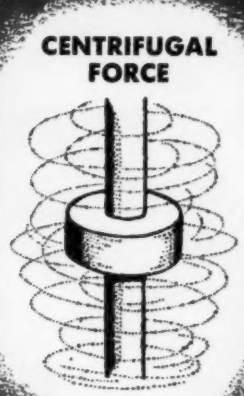
Consider a couple of the opportunities to sell and to sell safety. Think of tire needs. By no way, other than removing the tire from the car, can the dealer inspect the condition of the tire as thoroughly as is made possible by being under the car during, let us say, a lubrication job. And how about wheel bearings? You might think that during a lubrication job front wheel bearings are almost automatically checked. But in common with many other services required at intervals of ten thousand miles or more, this one is often passed over as "OK." However, the sales and safety conscious dealer recognizes in performing such services as lubrication jobs the opportunity to check up on such matters as wheel bearing condition. Even a battery sale can be accomplished on the proposition that a dead battery on a highway at night causes the motor-

IN common with many other services required at frequent intervals, ball joint suspension adjustment is often passed over as "OK," but the sales and safety conscious dealer recognizes the opportunity to check up on this.

Sure way to guard your greases against these 3 enemies:







Use a base of a

METASAP® ALUMINUM STEARATE

Metasap Stearates are known the world over as *the cleanest stearates made.*

Also, the Metasap technical staff is notably successful in supplying makers of greases with the exact properties they need for each specific task. There's a Metasap base which gives you a high gel type grease when *that's* what you need; another for a medium heavy gel where smoothness is your chief requisite; still another produces with great economy the semi-fluid, adhesive-type lubricant known as castor machine oil.

Each of these...and many more...and modifications of each to meet your most exacting needs, are at your service, together with the counsel of the most experienced stearate men in America.

Won't you call on them for their recommendations, soon?

METASAP CHEMICAL COMPANY

METASAP CHEMICAL COMPANY
HARRISON, NEW JERSEY
Chicago, Ill. • Boston, Mass.
Cedartown, Ga. • Richmond, Calif.

A NOPCO Subsidiary

the cleanest stearates made

ist to expose himself to road hazards such as speeding automobiles approaching an unlighted, stalled customer.

So admittedly, the dollar sign is present in our efforts to sell safety. But it's a worthy motive and the results are beneficial to everyone concerned.

Many folks believe that everything's "OK" unless trouble develops. Most motorists are blind to safety because they feel Godlike behind the wheel of their magnificently performing machine! The more initiated experts—the oil companies—the service station dealers—think that preventive treatment in the form of regular lubrication, and even more regular and thorough

CHECKING front wheel bearings should be done regularly —if there is too much grease it can run into the brakes.

observation, is the answer to sudden mechanical failure.

My own mother's and father's experience is a case in point. In their late sixties and early seventies, they like to drive a high-powered car across country at speeds in keeping with their age. That is to say, at high sixties and low seventies! Having a son in the oil business, they quite accept the theory of regular 1,000 mile lubrication jobs for their car. Not long ago in Maine, they left it across the street while they had a

BY no way, other than removing the tire from the car, can the dealer inspect the condition of the tire as thoroughly as is made possible by being under the car during a lubrication job—a thorough and easier method.

quick lunch at a highway restaurant. When they returned to pick it up, the dealer showed them where two of the three bolts which hold the steering gear assembly to the frame bracket were missing and the third bolt was nearly sheared off. The expense of another hour at a car agency's garage in town corrected the problem and my folks went on their way.

Now, maybe the gear assembly wouldn't drop off the car if the third bolt suddenly let go, and maybe the car wouldn't have gone completely out of hand, but I'm sure that two old folks going seventy might be pretty hard pressed to stay on the road.

This case and countless others like it suggest a recognition on the part of the dealer and his supplying oil company that they have a moral obligation to the motorist. Such courteous and highly moral acts of searching out possible trouble and suggesting preventive measures often bring no immediate revenue to the dealer, and certainly not to the oil company. Yet, a great effort is made by the oil companies to educate their dealers in this area of their responsibilities. Dealers all over the country take a personal interest in doing this sort of thing, and oil companies all over the country train their dealers to "observe and tell."

Through dealer publications they challenge service

American Potash & Chemical Corporation, through its subsidiary, American Lithium Chemicals, Inc., is a basic supplier of Lithium Hydroxide Monohydrate—vital to high quality multi-purpose greases.

LITHIUM BASE GREASE

one grease...in place of many ...for industrial lubrication needs!

Multi-Purpose Grease provides these outstanding properties...

- Water resistance
- High temperature bearing performance
- Low temperature pumpability
- Greater chemical and mechanical stability
- Stepped-up oxidation resistance
- Rust and corrosion prevention

"ONE-TYPE" grease for every purpose can now prevent the misapplication of lubricants in equipment, provide economies in storekeeping and manpower by eliminating special-purpose grease products. Lithium-base, multi-purpose lubricants simplify maintenance and minimize dispensing equipment required in industrial, farm and mobile equipment. A vital ingredient in these tough and versatile greases is Lithium Hydroxide Monohydrate, which imparts the ability to withstand wide ranges in temperature, water contamination and variable loads and speeds. For everything—from electric motors to locomotives—lithium-base greases will do the job and do it better.

Write for informational bulletin containing technical data on Trona* Lithium Hydroxide Monohydrate.

*TRADEMARK AP&CC

TRONA **American Potash & Chemical Corporation**

Producers of: BORAX • POTASH • SODA ASH • SALT CAKE • LITHIUM • BROMINE • CHLORATES • PERCHLORATES • MANGANESE DIOXIDE • *and a diversified line of specialized agricultural and refrigerant chemicals*

OFFICES • 3030 West Sixth Street, Los Angeles 54, California
99 Park Avenue, New York 16, New York
235 Montgomery Street, San Francisco 4, California
1320 S.W. Broadway, Portland 1, Oregon
214 Walton Building, Atlanta 3, Georgia

About the Author

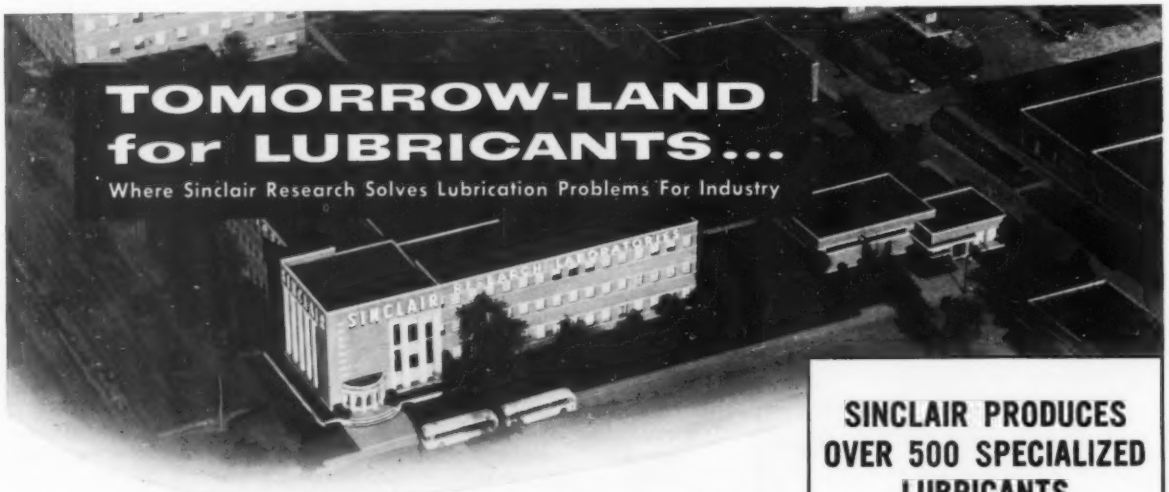
JAMES E. SIMONDS *is director of marketing training of Esso Standard Oil company. A native of New Orleans, he attended military school in the South and the University of Chicago. Simonds has held a variety of positions in the marketing departments of Socony Mobil Oil Co., Inc. and Esso Standard Oil company from junior salesman through manager of service operations, merchandising, service station selection and development, and dealer training. He was training supervisor in Esso's New England division prior to his present home office position.*

station operators to be on guard, and constant reference is made in every service station training program I know of, to any service factor contributing to safe driving.

Now I have one other fanatical belief—at least it's the only other one I'll admit to at this moment—and it is this: People (including service station dealers) can learn a lot from formal training, such as that provided at excellent retail schools operated by their suppliers, but they may learn far more and turn this knowledge to profit through their daily contacts with really expert salesmen—salesmen who think of salesmanship in terms of guiding the action of their dealers, and who use salesmanship to stimulate requests for guidance.

If I'm right in this, maybe it is the reason for more and more oil company attention to the training of their salesmen not only in using the basic principles and techniques of salesmanship, but in the skills of effective speaking, conference and meeting leading, and a new item in the field of winning friends and influencing people-dealer guidance.

Believe me, from all of this, profit is a result—but it is not a "quick buck"—it is good will and good business. ■



Located at Harvey, Illinois, is one of the most extensive installations of its kind in the world—Sinclair Research Laboratories. These facilities are an important part of Sinclair's investment in the future. Here is where Sinclair engineers and chemists work to develop new products and improve the quality of existing ones. At these famous laboratories were developed the Sinclair lubricants now solving difficult problems in all branches of industry. If you have a special lubrication problem, write today to Sinclair Refining Company, Technical Service Division, 600 Fifth Avenue, New York 20, N. Y.

SINCLAIR PRODUCES OVER 500 SPECIALIZED LUBRICANTS for

TURBINES
DIESEL ENGINES
PLANT MACHINERY
METAL WORKING
AUTOMOTIVE EQUIPMENT
and many other applications

SINCLAIR REFINING COMPANY

FUTURE MEETINGS of the Industry

MAY, 1957

1-3 API Division of Production (Eastern District meeting), William Penn Hotel, Pittsburgh.

6-8 API Annual Pipe Line Conference, Cleveland Hotel, Cleveland.

6-8 API Lubrication Committee, Grand Hotel, Point Clear, Ala.

13-16 API Division of Refining (midyear meeting), Sheraton, Hotel, Philadelphia.

15-17 Fuel Oil Distributors Association of New Jersey (annual convention), Hotel Berkeley, Carteret, Asbury Park, N. J.

16-17 National Industrial Conference Board (general session), Waldorf - Astoria Hotel, New York City.

19-22 Texas Independent Producers & Royalty Owners Association (annual meeting), Galvez and Buccaneer Hotels, Galveston.

20-22 API Division of Marketing, (mid-year meeting), Chalfonte-Haddon Hall, Atlantic City, N. J.

22-24 API Division of Production (Eastern District meeting), William Penn Hotel, Pittsburgh.

An Eastern Grease Manufacturer is desirous of buying a used or reconditioned Ross Conical Burr Stone Mill, style 1; size 4; vertical type; with gear drive.

Adaptable for grinding lubricating greases — reply to NLGI SPOKESMAN, Box No. M-1.

JUNE, 1957

2-7 Society of Automotive Engineers (summer meeting), Chalfonte-Haddon Hall, Atlantic City, N. J.

4-5 Petroleum Packaging Committee, Raddison Hotel, Milwaukee, Wisc.

9-14 API Division of Production (midyear committee conference), Muehlebach Hotel, Kansas City.

10-12 Interstate Oil Compact Commission (midyear meeting), Canyon Hotel, Yellowstone National Park.

16-21 ASTM, Chalfonte-Haddon Hall, Atlantic City, N. J.

16-21 ASTM Committee D-2, annual meeting Traymore Hotel, Atlantic City, N. J.

24-25 Michigan Gas Assn. meeting, Grand Hotel, Mackinac Island, Mich.

24-28 American Institute of Electrical Engineers (1957 Summer general meeting), Sharaton-Mt. Royal Hotel, Montreal.

AUGUST, 1957

12-15 National West Coast Meeting, Olympic Hotel, Seattle, Wash.

SEPTEMBER, 1957

9-12 Society of Automotive Engineers, national tractor meeting and production forum, Hotel Schroeder, Milwaukee.

10-11 Petroleum Packaging Committee, Point Edward, Ontario, Canada.

11-13 National Petroleum Association (55th annual meeting), Traymore Hotel, Atlantic City, N. Y.

22-24 Tenth Annual Meeting of the Independent Oil Compounders Association. Carter Hotel, Cleveland, Ohio.

30-Oct. 2 American Oil Chemists' Society (1957 Fall meeting), Netherland Plaza Hotel, Cincinnati.

OCTOBER, 1957

1-2 Texas Mid-Continent Oil & Gas Assn. (38th annual meeting), Texas Hotel, Fort Worth.

1-5 National Aeronautic Meeting, Aircraft Production Forum, and Aircraft Engineering Display, The Ambassador, Los Angeles, Calif.

28-30 NLGI Annual Meeting, Edgewater Beach Hotel, Chicago, Ill.

6-10 ASTM Committee D-2 meeting, Sheraton-Park Hotel, Washington, D. C.

McGEAN 30% LEAD NAPHTHENATE ADDITIVE

Consistently uniform in metallic content and viscosity

Fully clarified by filtration

Non-Oxidizing - - - contains no unsaturated soaps

Free from low flash constituents

your inquiries solicited

THE McGEAN CHEMICAL COMPANY

MIDLAND BUILDING • CLEVELAND 15, OHIO

Detroit • Grand Rapids • Chicago

Patents and Developments

Kettle-Cooled Lithium Stearate Grease Containing Alcohol

According to U. S. Patent 2,769,781, issued to Socony Mobil Oil company, the advantages of kettle-cooling, in contrast to pan-cooling, can be obtained in the manufacture of lithium base greases by adding a gel stabilizer to the grease.

It is an object of the patent to provide a grease having a lithium soap of a fatty acid other than hydroxy fatty acids as the primary gelation agent and containing a gel stabilizer.

Lithium stearate greases devoid of a gel stabilizer when kettle-cooled are not satisfactory greases, whereas when a gel stabilizer is included in the formulation the kettle-cooled grease is satisfactory.

Hydrogenated sperm oil has the following characteristics:

Melting point, °F	118-126
Free fatty acids, per cent	2
Saponification No. (mg. KOH/g.)	135-145
Iodine No.	6 (max.)
Unsaponifiables, per cent	35

This product contains about 2.0% glyceride and the balance is esters of the high molecular weight (C_{12}-C_{18}) aliphatic monohydric alcohols. The saponification number is for total saponification which includes the saponification of the glycerides and the alcohol esters. The alcohols are present as esters in the hydrogenated sperm oil in the concentrations shown in the following tabulation:

	Per Cent
Myristyl alcohol (Tetradecanol, C_{14})	1.1
Cetyl alcohol (1-hexadecanol, C_{16})	18.4
Octadecyl alcohol (9-octadecanol C_{18})	1.5
Stearyl alcohol (octadecanol, C_{18})	12.5

It will be noted that while the higher molecular weight monohydric aliphatic alcohols are effective as gel stabilizers in the kettle cooling of lithium stearate-base greases, glycerine being representative of a polyhydric alcohol, is not.

Gel stabilizers of the present patent are (1) a minor proportion of hydroxy fatty acid soaps particularly the sodium soap of 12-hydroxy stearic acid in a concentration effective to produce a smooth textured kettle-cooled grease say about 1 to about 2% calculated as sodium 12-hydroxy stearate and (2) a minor proportion, effective to produce a smooth-textured, kettle-cooled grease, of the higher monohydric aliphatic alcohols having from 12 to 34 carbon atoms, preferably 16 to 34 carbon atoms, such as cetyl, ceryl, the alcohol of Chinese wax, melissyl alcohol, $C31H_{63}OH$, from beeswax or carnauba wax, other alcohols having 32 and 34 carbon atoms and present in carnauba wax in a concentration of 0.3 to about 2.0 per cent by weight.

A suitable formulation for the preparation of kettle-cooled lithium stearate base grease is the following:

	Per Cent Weight
Hydroxystearic acid*	1.0
Sodium Hydroxide	0.2
Stearic acid	10.0
Lime flour	0.3
Lithium hydroxide (mono-hydrate)	1.3
Mineral oil S.U.V. at 100°F. 800 seconds	85.8
Phenyl alpha naphthyl amine	0.2
Basic barium salt of wax benzene (2-12) sulfonate	1.0
Polymeric isobutylene molecular weight about 700,000†	0.2
	100.0

*Preferably 12-hydroxystearic acid available at "Hydrofol Fatty Acid 200."

†Available under the trade name "Paratac."

Aluminum Soaps

One patent (2,768,996) issued to the Commonwealth Engineering company describes a novel method of making soaps, particularly aluminum soaps, and, although grease uses do not appear to be mentioned, it is possible that such soaps could be employed for this outlet.

Briefly, in accordance with this patent, the uniform, readily reproducible metallic soaps are obtained by a method involving the use of an aqueous sodium salt solution and an aqueous aluminum salt solution and in which the sodium salt solution is added to the slight (2-10%) stoichiometric excess of the aluminum salt solution, said excess being sufficient to keep the pH sufficiently low to prevent precipitation of $Al(OH)_3$.

This new method is claimed to constitute a direct reversal of the known and commonly used precipitation method, wherein aluminum salt solution is added to the soap solution, and most of the soap formation takes place in alkaline solution which permits the formation of $Al(OH)_3$. The essence of this patent resides in the unexpected discovery that the manner in

which the two solutions are brought together determines the uniformity or non-uniformity of the soap formed, and more especially, leads to a predictable stoichiometric product.

When the soap solution is added to the aluminum salt solution, there is an instant "strike" when the addition is started, with immediate precipitation of the di-soap, which continues to precipitate as addition of the sodium soap solution progresses. The precipitated aluminum soap, being far more insoluble in acid media than the hydroxide, is only very slowly altered by changes in the solution and, since the product precipitated is of the same composition from the beginning to the end-point of the sodium salt addition, and the precipitation occurs homogenously from a minimally supersaturated solute without the possibility of batch accidents tending to induce variations, the composition of the final soap is essentially uniform.

It is also stoichimetric in that large excesses of alkali, above 50%, do not appreciably alter the fatty acid anion/aluminum cation ration in the product soap.

The aluminum soaps of the patent have the formula $AlOHR_2$, in which R represents the anion radical of the acid HR, which may be any organic acid capable of forming an aluminum soap. The organic acid HR may be written as–

$$HC_nH_{2(n-p)}-_1O_2$$

in which n is the number of carbon atoms present in one molecule of the acid, and p is the number of electron pairs contributed by those atoms (a) forming saturated linkages between themselves or (b) forming themselves into rings. Experimentally the values for n and p can be assigned by determining the "acid" and the "iodine #" for the particular acid and solving equations for n and p therefrom.

In many instances, in industrial practice, the fatty acid is actually a complex mixture of such acids and some non-saponifiable material which later must be allowed for making up the starting batches and in determining n and p to characterize R for the purpose of determining the value f used herein to designate the fatty acid anion-aluminum cation ratio of the product soap. In mixtures, the atomic parameters are not necessarily intergers. Thus, for an equimolecular mixture of stearic, oleic, linoleic and palmitic acids the value of n is 17.6 and that of p is 1.2. Moreover, the acids which may be used are not limited to those containing only carbon, hydrogen and oxygen, as will be apparent from the examples given. A specific instance is the laurylsarcosinates which contain nitrogen. In general, the acids used in practicing the method of the patent may include modified fatty acids containing halogen, sulfur, phosphorus and various substituted functional groups such as hydroxyl groups, keto groups and others so long as the capacity of the acid to form an aluminum soap is not impaired. Surprisingly, acids the sodium salts of which are not sodium soaps, such as butyric and valeric acids, do form aluminum soaps by the present method.

Specifically, the method of the patent is applicable to the production of (a) aluminum soaps of formula $AlOHR_2$, in which R is derived from an organic acid containing four to more carbon atoms, either straight or branched chain, or unsaturated, for example to soaps obtained using such normally liquid acid salts of the metal as the butyrate, caproate, caprylate, 2-ethylhexanoate or 3-ethylheptanoate and (b) those soaps in which R is derived from a normally solid saturated aliphatic acid of high carbon content, e.g., those made using salts of sodium such as the laurate, palimate, stearate and behenate. The soaps of type (a) are characterized in that they are not hydrolyzed in weakly acid, weakly alkaline or neutral solutions but hydrolyze in moderately acide and moderately alkaline solution, while those of type (b) are chiefly characterized in being stable in more strongly alkaline media than the soaps of type (a).

The sodium salt solution and the aluminum salt solution are prepared in the usual ways and the former is added to the slight stoichiometric excess of the latter at ordinary temperatures and with continued stirring. The aluminum soap which precipitates is filtered, washed free of salts, and placed on trays and dried at the usual low to moderate temperatures. The soaps are not usually pure in the sense of being strict chemical entities since the natural fats and oils generally used yield mixed fatty acids. They are, however, essentially homogeneous in that, throughout, the number of R groups per aluminum atom is substantially 2.0.

It appears that the markedly greater capacity of the aluminum soaps to body oils, fats and hydrocarbons is due to the "free" OH group present in those soaps. No other metallic soaps have been shown to have this group with the possible exception of gallium and indium soaps. Evidently, the presence of this OH group is an alumnium content property, since in $Al(OH)_3$, variety gibbsite, all the OH groups are bound, i.e., bonded to each other and incapable of forming chains with organic molecules such as are required for stiffening or bodying the latter, and soaps containing more Al than required for the formula $AlOHR_2$ are inferior gelling agents. On dispersion in an organic medium, aluminum soap molecules link with the solvent to swell them and then the linked domains cross-link with each other to gel. At the same time that the OH group permits this linking and cross-linking, it inhibits miscibility of soap and solvent so that, unlike gallium, iron and chromium soaps, aluminum soaps do not dissolve in organic or other covalent solutes without thickening them, and thus aluminum soaps have the capacity to gel combustibles for fire bombs, chloro- or fluorocarbons for pressure fire extinguishers, auto-inflammatory materials suitable for jet igniters or re-igniters for planes, rockets and guided missiles. The advantage of the homogeneous soap

produced by the present method resides in that it is a more efficient bodying agent than the presently commercially available non-uniform soaps and, moreover, because of the uniformity thereof, can be used in the correct, exact calculated amounts to accomplish a given effect.

Channeling Type High Temperature Anti-Friction Lubricant

For lubricating some types of anti-friction bearings, particularly ball bearings, the grease composition necessary to furnish the desired long and continuous lubrication at elevated temperature is a "channeling" type grease. That is to say, a grease which gives a low torque and low bearing temperature rise is needed, since, in an operating bearing of this type, the major portion of the grease is pushed out of the path of the rolling elements during the first few revolutions of the bearing and remains out of this path. Thus, no unnecessary power loss or heat build-up occurs in moving the grease in the bearing after the first few minutes of operation. The excess grease thrown out of the ball path then acts as a lubricant reservoir and as a seal to prevent entrance of dirt and other undesirable contaminants into the lubricated bearing. This "immediate channeling" type grease is obtained in the prior art by high soap concentration, the grease structure being modified during manufacture to obtain a relatively high penetration. The requirements of a grease of this type are as follows: a high dropping point usually in excess of about 350°F; soft, unctuous characteristics; and a stable structure.

An excellent channeling type grease is claimed to be described in detail in Patent No. 2,265,791. The grease composition of this patent is prepared by thickening a mineral lubricating oil to a grease consistency with a relatively large proportion of the sodium soap of refined rapeseed oil. There is also present in the finished grease a slight excess of sodium hydroxide. There may also be present, if desired, a small percentage of an oil-soluble petroleum sulfonate. This grease composition is said to give excellent long continuous service in both high and low temperature ball bearing operation and in service where the temperature may vary over extremely wide ranges as sometimes occurs in refrigeration equipment, i.e., temperatures ranging from + 300°F or even higher to temperatures about — 30°F.

In general the channeling type lubricating grease compositions described above are excellent for lubricating ball bearings. These greases, however, are less desirable for use in roller bearings since different and more complex lubrication problems exist in these bearings. It has been found that the action of both ball and roller bearings causes the high soap content grease compositions to become stiffer and the desired soft unctuous characteristic necessary for bearing lubrication is lost. While this hardening is desirable in ball bearing use, allowing ease of channeling, it is undesirable in roller bearing service since hardening and channeling prevent satisfactory lubrication of the roller shoulders and back roller surfaces. This is particularly noticeable in double row bearings.

These prior art channeling greases also tend to harden on storage because of the unbalanced grease structure, that is, the abnormally high proportion of soap to oil base. Upon standing, the grease which has been churned or stirred down to the desired consistency (penetration) tends to settle, or "snap back" to the consistency which is normal for the high soap content.

According to U. S. Patent 2,758,973, issued to Esso Research and Engineering company, there is disclosed a lubricating grease claimed to have desirable high temperature properties suitable for use in ball or roller bearings by a process which utilizes a synthetic lubricating oil to cut back a complex soap base grease and a subsequent hardening to grease consistency of the mixture with the application of high rates of shear without concurrent mixing. This improved technique is claimed to result in the following advantages:

1. Greases having channeling properties and proper consistency which will satisfactorily lubricate anti-friction bearings without undesirable loss of power, heat rise, or premature bearing failure.

2. Decreased tendency to harden during use in a roller bearing, thus maintaining the proper consistency to work into roller bearing crevasses and shoulders during use.

3. Decreased tendency to harden during storage, since the desired consistency (penetration) is achieved with a smaller amount of soap than was hitherto believed possible.

4. An obvious economic advantage due to retention of the required consistency for anti-friction bearing lubrication with considerably smaller amounts of soap than the prior art has heretofore thought necessary.

5. Improved lubrication properties at both elevated and low temperature due to the inclusion of a synthetic lubricating oil.

This patent involves a process for the preparation of high temperature lubricating grease compositions which comprises the steps of preparing a mixture of a complex soap and a mineral oil, heating the mixture to a temperature above about 480°F. to completely dissolve the soap, and cooling the mixture to a temperature of about room temperature to 250°F. When the grease has reached this temperature and the complex soap crystals have attained their optimum growth, a synthetic lubricating oil is added and the total mixture is subjected to high rates of shear without concurrent mixing to form the desired final product.

The first step in the improved process is the formation of a mixture of a complex soap and a mineral oil. By complex soap is meant those thickening agents

which comprise a complex of two or more components. Complexes may be formed from high molecular weight acid soaps and low molecular weight acid salts such as the salts of acetic, acrylic, methacrylic, furoic acid, etc. The soap of the rapeseed oil glyceride, such as that described in U. S. 2,265,791, is one such complex soap and is utilized in the preferred embodiment of this invention.

It has been found in the prior art that the metallic soaps, preferably the sodium soaps of refined unblown rapeseed oil, produce a grease having desirable high temperature properties. The sodium soap of rapeseed oil is ordinarily prepared by admixing the rapeseed oil with a portion of a mineral base oil, usually a coastal type oil having excellent soap solvency properties but relatively low flash and correspondingly high volatility inherent in lube oils derived from aromatic type crudes. A viscosity index within the range of from about 45 to 60 is desirable. An aqueous solution of the desired metal hydroxide is then added. The temperature is raised gradually to one at which the neutralization products of the rapeseed oil becomes completely soluble. Ordinarily, this will be within the range from about 480°F to 520°F or higher.

Any addition agents used, such as oxidation inhibitors, etc., are added along with any additional quantity of the base oil used, prior to the final temperature attained, that is, they are usually added at a temperature in the range of 250°F. to 300°F.

Once the grease is cooled to a temperature such that the soap crystals have attained their optimum size, that is, to a temperature within a range of from room temperature to 250°F, there is added to the formulation a quantity of a synthetic lubricating oil and the mixture is then thickened to a greae consistency by the application of high rates of shear without concurrent mixing.

The synthetic lubricating oil that is used to cut back the complex soap grease may be any of the synthetic oils known to the art. Generally preferred, are esters of glycols, polymerized glycols, glycol ethers, complex esters such as alcohol-dibasic acid-glycol esters of alcohol-dibasic acid-glycol monobasic acid esters, or blends of esters. It is generally found that esters containing from about 10 to 30 carbon atoms are most desirable, and may be either of branched or straight chain configuration. Exemplary of these especially preferred synthetic lubricants are the following: di-2-

Introducing the

NEW **JAYHAWK MILL**

(for petroleum products)

Built into this modern high production Jayhawk Mill are the features you have always wanted:

STRENGTH to withstand severe service,

POWER to handle any material, and

SIMPLICITY so that any operator can handle and understand it.

Write for full details -- today.

THE JAYHAWK MANUFACTURING CO., INC.
120 North Adams Street – HUTCHINSON, KANSAS – Phone MOhawk 2-6696

ethyl hexyl sebacate, di-octyl sebacate, di-nonyl sebacate, di-2-ethyl hexyl adipate, diC_7 Oxo adipate, di-C_8 Oxo adipate, di-C_{13} Oxo adipate, complex esters such as the ester formed by reacting two mols of a half ester of C_4-C_{10} alcohol and a dibasic acid with one mole of a polyethylene glycol, etc., and the mixtures of the above.

In addition to the ester type synthetic lubricating oils, other synthetic oils may be used. Polymerized silicone oils, long-chain formals, carbonates, polymerized olefins, copolymers of aliphatic and aromatic compounds, etc. are also operable in the process. The only limitation upon the synthetic lubricant chosen as the cut back oil is that it have characteristics that are to be utilized in the finished lubricating grease formulation.

After the grease has been cut back with the synthetic oil, the total mixture is subjected to rates of shear in the order of 10,000 to 500,000 reciprocal seconds or more in an apparatus designed to deliver these rates of shear without concurrent mixing. This equipment is so designed as to cause the grease to flow at high velocity and high pressure under streamlined conditiosn. Equipment such as the Gaulin homogenizer, manufactured and sold by the Manton-Gaulin Manufacturing company of Everett, Massachusetts, or rolling mills wherein the grease passes through steel rollers with minute clearances may be used. The well known Morehouse mill wherein the milled material passes through spinning discs at low clearances is also operable but less desirable. A pressure visicometer, if operated at sufficiently high pressures to deliver rates of shear within the desired range, may be used to achieve the desired results. Various other mechanical means may also be used for the application of this shearing force to grease formulation so long as no concurrent mixing occurs.

The original soap content used will be such as to give a grease formulation containing from 20% to 50% soap before the addition of the synthetic oil. It has been found that by the former processes of the prior art, a soap content within this range is required to give the desired ASTM penetration of 200 and 350 mm./10. The quantity of synthetic lubricating oil added will be such as to reduce the overall soap content of the final product to one within a range of from 6% to 18%. The subsequent treating step, subjection to the high rates of shear without concurrent mixing, results in a finished product having a penetration value of between 200 and 350 mm./10, preferably 275 to 300 mm./10. It is to be noted that a lubricating grease having a penetration within the desired range is obtained with a fractional amount of the total soap, content hitherto thought necessary.

The lubrication life of an anti-friction bearing lubricant has been thought to be generally proportional to the amount of soap present. It has been found that the lubricating compositions of this patent containing approximately ¼ to ⅓ the amount of soap hitherto thought necessary, give a lubricating life comparable to the prior art greases. This is due to the incorporation of the synthetic lubricating oils which are generally excellent for this purpose.

Lithium Greases

It is well established that the quality of a grease varies substantially with the method of making it, and also that a satisfactory process for forming a grease of one metal soap and oil is not necessarily satisfactory, or even operative, for another metal soap even though the same oil be used. This is believed to be due to the fact that different types and lengths of fibers or micelle structures are formed by different soaps, and by the same soap when different processes of forming the fibers are utilized. Moreover, the degree of orientation and twist of the fibers is a variable from grease to grease and affects the physical properties thereof.

Grease fiber or micelle formation is essentially a process of crystallization which is brought about by cooling a solution of soap from a relatively high temperature to a lower temperature at which the soap is insoluble in the oil. Various factors including rate of cooling and the degree of agitation during cooling through the critical crystallization range and thereafter affect the type of fibers which are formed. After the fibers have been formed the structure may be modified by milling which tends to minimize sineresis and improve the stability of the grease.

The heretofore prevalent process for manufacturing lithium grease involves the following steps: Initially, a slurry of lithium soap in mineral oil is prepared in open kettles and heated to a temperature of about 400°F. to completely dissolve the soap. The soap may be prepared separately or in the slurry kettles from fats or fatty acids and lithium hydroxide in the presence of part or all of the oil. If only part of the oil is used to form the soap the remainder of the oil is added after saponification is completed and the slurry is heated to solution temperature. The solution of lithium soap in oil is then drawn from the kettle and allowed to cool statically, usually in open pans, until a gel is formed. The cool gel is then subjected to a milling operation in which it is worked to form a homogeneous grease composition. This process is claimed to have a number of practical disadvantages. The high temperature heating in open kettles results in loss of more volatile components from the oil and creates a fire hazard. The process involves considerable manual handling of pans of gelled grease both in filling and feeding the gelled grease into the mill, which is time consuming and involves a danger of contamination. For these and other reasons, the process cannot be controlled to produce uniform greases from batch to batch, and, even more important, the yield of grease which may be obtained from a given amount of soap is low. It is necessary to deaerate the grease during the milling operation. Furthermore, from the standpoint of economy of operation, the power required to mill the cooled grease is quite high, and the heat requirement to raise the slurry

including the entire amount of oil in the grease to solution temperature is considerable.

U. S. Patent 2,760,936, issued to National Cylinder Gas company claims to provide an improved process for producing lithium grease which may be operated on a continuous or semi-continuous basis and which produces higher yields of grease from given amounts of soap (the most expensive constituent) and also produce grease of more uniform characteristics and superior quality. Moreover, the process is claimed to result in economies in labor, electric power and heat required.

One of the important features is the discovery that the above-mentioned improvement may be obtained by blending a hot solution of the soap in part of the oil with additional oil having a substantially lower temperature, such blending being accomplished within a certain critical temperature range and under conditions of extremely mild agitation conducive to complete mixing with low shear. For practical purposes the critical temperature range lies between about 230°F. and 310°F. Following this rapid shock chilling by blending the resultant grease is additionally cooled under conditions of violent agitation to a temperature below a second critical temperature below which the soap micelle is stable and which was found to be about 160°F. The grease may then be finished by milling in the conventional manner. In connection with the milling operation, considerably less power is required to mill the grease than in the case of pan cooled greases. The reason for this is not fully understood, but it is believed to be due to the fact that the rapid chilling without substantial agitation during the blending step produces more soap micelle or fibers of the desired size and a lesser number of fibers of excessive length so that substantially all of the fibers are of the desired size and less milling power is required to break down overly long fibers.

This factor of proper fiber growth initially in the cooling step is also believed to account for the higher yields experienced since the fibers which are formed are utilized with greater effectiveness in the gel to produce adequate penetration values or stiffness in the finished grease even though the soap is present in smaller amount. Obviously of a pan cooled grease must be worked to reduce extra long fibers, that same working reduces the shorter fibers to less than optimum gel forming length.

Another claimed advantage of the process is that virtually no gel forming time is involved. Gelation is completed by the time the grease is cooled below the second critical temperature, and consequently no holding vessels are required.

Figure 1 is a flow diagram of the system used, and is self-explanatory. Numeral 16 represents the heating unit and Numeral 17 the cooling unit. These units are depicted more in detail in Figures 2 and 3, while Figures 4 and 5 give details of the blender used. Figure 6 is a graph showing the effect of blending temperature on penetration, while Figure 7 is a graph showing the effect of blender shaft speed on penetration.

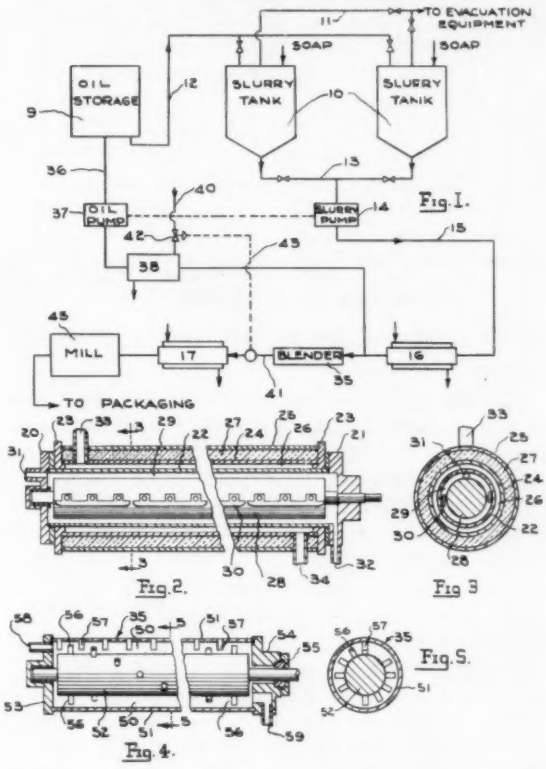


Fig. 1.

Fig. 2.

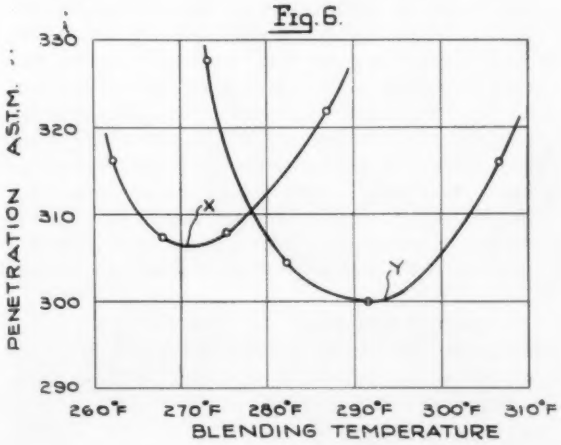
Fig. 3

Fig. 4.

Fig. 5.

FIGURES 1 through 5 illustrate the National Cylinder process for producing lithium grease continuously.

FIGURE 6 shows the effect of blending temperature on penetration . . . 60 stroke penetrations give curve Y.



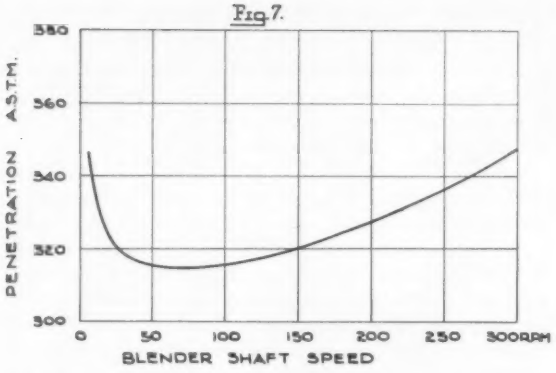


FIGURE 7 effect of blender shaft speed on penetration.

Example

Fourteen pounds of prepared lithium stearate known as Witco #306, having a softening point of 210°C. and manufactured by the Witco Chemical company, 295 Madison Avenue, New York, New York, were mixed with eighty-six pounds of a naphthenic petroleum oil, having a pour point of -15°F., a flash point of 410°F., a viscosity of 650 SSU at 100°F. and 60.6 SSU at 210°F., and a viscosity index of 41.8, to form a slurry containing 14% lithium soap. This slurry was then pumped through a heating unit similar to unit 16 shown in Figures 1-3 at a rate of approximately 75 pounds per hour. The shaft speed in the unit was 500 R.P.M., and the temperature of the slurry was raised to about 425°F. The resultant hot solution was blended with one hundred pounds of the same oil having a temperature of about 160°F. by pumping the oil and hot solution through a 10 foot length of ½ inch pipe having eight right angle bends to form grease at a temperature of approximately 290°F. The cold oil was supplied at a rate of about 75 pounds per hour so the combined flow through the pipe was about 150 pounds per hour. Pumping the hot solution and cold oil through the pipe produced a gentle agitation equivalent to that provided in the rotating shaft blender described above when the shaft is rotated at very low speeds to provide rapid chilling of the hot solution with very low shear. Immediately after blending the grease was passed through an agitated cooling unit, similar to that hereinbefore described and having an agitator shaft speed of 500 R.P.M., to lower its temperature to below 150°F. The rate of flow through the cooling unit was about 150 pounds per hour. Next the grease was worked in a Charlotte colloid mill(Model W10).

The finished grease had a soap content of 7% and a penetration (ASTM) of 300 after 60 strokes in a conventional grease worker. It exhibited no bleed upon standing and stood up well on additional working, showing a difference of penetration of only 33 after 10,000 strokes in the grease worker.

In order to determine the effect of blending temperature on the "yield" as measured by penetration, a series of greases was prepared by the procedure of the above example with all conditions maintained the same except that the cold oil temperature was varied to give a series of blending temperatures from about 274°F. to about 307°F. The 60 stroke penetrations of the resultant greases were measured and the results when plotted gave the curve Y illustrated in Figure 6. The grease having the lowest penetration value was obtained with a blending temperature of about 290°F.

Water-Resistant Lubricants Thickened With Inorganic Gelling Agents

A non-soap gelling agent which has found considerable application in the preparation of lubricating greases is finely divided silica. This material when dispersed in a suitable liquid medium including petroleum oil lubricating fractions, will produce a gelatinous composition with a greaselike structure having lubricating properties. The development of inorganic gelling agents apparently originated in Germany during World War II as a solution to the shortage of conventional grease making components. Greases employing inorganic gelling agents can be prepared in the standard type of grease making equipment without requiring unusual processing conditions. Although the greases thickened with inorganic gelling agents are suitable for multi-service duty, their resistance to changes in consistency over a wide temperature range makes them very desirable compositions for high temperature applications. While the consistency of soap-thickened greases at elevated temperature is inimicably affected, greases thickened with inorganic gelling agents retain their grease structure. If working of these greases has occurred, the base oil may distill or even ignite, but no melting of the grease results. Unfortunately, these multi-purpose greases do not present an ideal solution to lubricating problems inasmuch as one serious deficiency in greases thickened with inorganic gelling agents is demonstrated by their lack of water resistance. This characteristic is fatal because exposure of a simple admixture of silica and oil to water results in the rapid disintegration of the mixture into its component parts. However, this difficulty may be overcome by treating the gelling agents employed in the preparation of these greases with suitable reagents, the inorganic gel-oil composition can be stabilized against the detrimental effect of water.

According to U. S. Patent 2,751,349 issued to the Pure Oil company, hydrophobic gelatinous compositions having lubricating properties can be prepared by incorporating into an oleaginous base an inorganic hydrophilic gelling agent and a tin halide, the latter constituent functioning as a waterproofing agent for the gelling agent. In carrying out this process, it is preferred that tin halides which are normally liquids be

employed in order to facilitate the manufacture of the composition. Examples of suitable compounds of this nature include $SnBr_3Cl$, $SnBrCl_3$, $SnCl_4$, $SnCl_2I_2$. This property permits the liquid halide to be incorporated in the composition in any convenient fashion, such as pretreatment of the gelling agent by contacting it with the liquid halide, or introducing the halide during the formulation of the gelatinous composition. In the event that a crystalline halide such as $SnBr_2$, $SnBr_4$, $SnCl_2$, SnI_2, SnF_4, etc. is employed, it will be necessary to prepare a solution of the halide by employing alcohol, ether, benzene, acetone or other suitable substance as a solvent. The gelling agent is contacted with the solution and wetted thereby to remove the solvent material. By treating the gelling agent, such as by heating the halide-impregnated gel at a temperature sufficient to drive off the solvent without affecting the removal of any of the halide, the agent is made water resistant by the remaining halide. It is evident that the presence of the halide produces a surface-active effect which is made manifest by the production of a hydrophobic gelling agent from one which is inherently hydrophilic in nature. The amount of tin halide which may be employed for improving the water resistance of gelatinous compositions having lubricating properties will depend upon the characteristics of the gelling agent. The proper amount of halide required to produce a hydrophobic composition is best determined experimentally. Generally, about 1-35% by weight, based on the gelling agent, may be employed and preferably amounts between 8-25% by weight.

The gelling agent which may be employed in this invention include a number of substances. There are a number of inorganic materials which impart poor water resistance to greases in which they are employed as gelling agents. These include inorganic gels formed from the polyvalent metal oxides and hydroxides. The most commonly employed gelling agent of this nature is silica gel in the so-called aerogel form prepared in accordance with the instructions set forth in U. S. Patent 2,260,625. Similar aerogels suitable for use in this invention may also be prepared from the oxides and hydroxides of alumina, calcium, chromium, cobalt, germanium, iron, lead, manganese, molybdenum, nickel, etc. and may be treated in accordance with this patent to produce gelling agents which will form water resistant greases.

The patent is not concerned with inorganic gelling agents per se but rather with imparting water resistance to the substances by a suitable treatment thereof. Accordingly, any of the conventional water-susceptible, inorganic amorphous gelling agents which have known application as gelling agents in the preparation of lubricants of grease-like consistency are considered within its scope.

Lubricating compositions employing this process can be prepared without resorting to special precautions. Conventional grease-making equipment and techniques can be employed. If the gelling agent is of sufficiently small particle size, a satisfactory composition can be prepared by simple admixing of the gelling agent and the oleaginous vehicle. A gelling agent having the desired particle size is marketed as Santocel ARD by Monsanto Chemical Co. Other gelling agents require the milling of the gel-oil mixture in conventional grease making equipment, such as a Charlotte colloid mill, in order to produce a gelatinous composition. Sufficient amounts of gelling agent to provide a composition having a desired consistency are employed. This generally requires amounts from about 2-20% by weight, based on the total composition, of the gelling agent. However, satisfactory compositions can be prepared using from about 5-14% by weight. As it was pointed out above, the method whereby the waterproofing substance of this invention is added depends upon the physical state of the halide employed. While crystalline halides must be added to the gelling agent surfaces by means of a pretreatment process, liquid tin halides may be introduced during the processing. In any event, precautions must be taken to insure the intimate contacting of the gelling agent with the halide in order to impart water resistance characteristics to the gelling agent. For further information on the preparation and properties of oils thickened with amorphous inorganic gelling agents, reference is made to the Institute Spokesman, XVI (10) at page 18 et seq. where silica aerogel-thickened greases are comprehensively considered.

In accordance with this patent a gelatinous lubricating composition is prepared by admixing 90 parts by weight of a petroleum oil lubricating fraction consisting of a 100 V. I. 85 viscosity neutral lubricating oil obtained from a Van Zandt crude oil, 10 parts by weight of a silica aerogel (Santocel ARD) and 2 parts by weight of stannic chloride. Upon intimately contacting the admixture in a suitable mixing device a thickened composition of greaselike consistency, having excellent water resistance is produced.

Additional Patents

U. S. Patents:

2,752,073-4 (Henry Martin)—Grease guns.

2,758,758 (Ezra W. Schimpf)—Grease gun.

2,759,640 (Harold H. Deupree)—Cartridge grease gun.

2,767,885 (Aro Equipment Corp.)—Strap supported lubricator.

2,770,507 (Keystone Lubricating Co.)—Grease relief fitting.

2,772,813 (Paul L'Heureux)—Grease can receiving grease ejector.

2,773,630 (Mascher et al)—Grease gun.

2,773,514 (Compopiano)—Accessory (cap) for a grease gun fitting.

2,772,029 (DeLucia)—Means for filling grease cups on automotive vehicles.

2,776,026 (Rockwell Mfg. Co.)—Lubricant fitting.

PEOPLE in the Industry

C. J. Boner Contributes to Encyclopedia of Chemistry

Kansas City's growing scientific center gains recognition in a new *Encyclopedia of Chemistry* which was recently published.

Included in the encyclopedia is an article on lubricating greases, told from a chemical standpoint, which was contributed by Charles J. Boner, chief research chemist for the Battenfeld Grease & Oil corporation.

Other articles were contributed by the Midwest Research Institute and the Linda Hall library.

This encyclopedia sells for $17.50 per copy and may be purchased from Reinhold Publishing company, 430 Park Avenue, New York City.

Bray Names Deane Sales Manager

The appointment of Thomas N. Deane as sales manager of Bray Lubricants company is announced by Dr. Ulric B. Bray, president.

Mr. Deane obtained his B.S. degree from Tulane university and is a member of The American Chemical Society, and the American Society of Lubricating Engineers.

Prior to this appointment Mr. Deane was with Bray Oil company in Los Angeles, where he worked for two years in the research and control laboratories and for four years as assistant to C. L. Haserot, general sales manager.

Lithium Corp. Creates Public Relations Department

Herbert W. Rogers, president of Lithium Corporation of America, Inc., announces the creation of a public relations and advertising department with headquarters in Minneapolis under the direction of Myron G. Herre, formerly plant manager at St. Louis Park, Minnesota.

Mr. Herre will be succeeded at St. Louis Park by Harold Andrews who was assistant manager of the corporation's Bessemer City, North Carolina, plant.

Both Herre and Andrews are graduates of the University of Minnesota in chemical engineering.

The new department brought about by the corporation's rapid growth will consolidate public and industrial relations, personnel, and advertising under unified control to facilitate the setting of uniform company-wide policies in these fields for LCA.

Ashland Appoints Sargent Manager Industrial Sales

Frank J. Sargent has been appointed to the newly created position of manager, industrial sales, in the national accounts department of the Ashland Oil & Refining company and its affiliated companies, it was announced by Everett F. Wells, president of Ashland Oil. He will be located at the home office in Ashland, Kentucky, and operate under the supervision of F. M. Moffitt, vice president.

Continued on page 42

SIGN OF
CORRECT LUBRICATION
Mobil
Makers and Marketers of
Mobil Automotive
Products
Mobil Industrial
Oils and Greases
Socony Mobil Oil Co., Inc.
and Affiliates: MAGNOLIA PETROLEUM CO.
GENERAL PETROLEUM CORP.

HARSHAW LEAD BASE

Harshaw Lead Base, as an additive to petroleum lubricants, improves extreme pressure characteristics and imparts the following desirable properties:

- Increased film strength
- Increased lubricity
- Improved wetting of metal surfaces
- A strong bond between lubricant and metal surfaces
- Resistance to welding of metals at high temperatures
- Moisture resistance and inhibits corrosion

Harshaw Lead Bases are offered in three concentrations to suit your particular needs:

Liquid 30% Pb	Liquid 33% Pb	Solid 36% Pb

Other metallic soaps made to your specifications. Our Technical Staffs are available to help you adapt these products to your specific needs.

THE HARSHAW CHEMICAL CO.
1945 E. 97th Street • Cleveland 6, Ohio
Branches In Principal Cities

Technical Committee

Chairman T. G. Roehner, Manager Technical Service Laboratory, Socony Mobil Oil Company, Inc.

Messrs. J. L. Dreher of California Research corporation and M. J. Pohorilla of Kendall Refining company are making good progress in organizing the symposium which will be included as part of the agenda for the NLGI Technical Committee meeting in October. The tentative title of the symposium is "Fundamental and Practical Aspects of Bleeding of Lubricating Greases." As indicated by the title, an opportunity will be provided for discussions of the latest research discoveries regarding the factors which influence the tendency of greases to bleed oil.

At this date, organization of the Joint SAE-NLGI committee on Chassis Lubricants has not been completed. The NLGI representatives for the exploratory meetings of that committee will be the following:

L. C. Brunstrum
M. Ehrlich
T. G. Roehner
J. B. Stucker

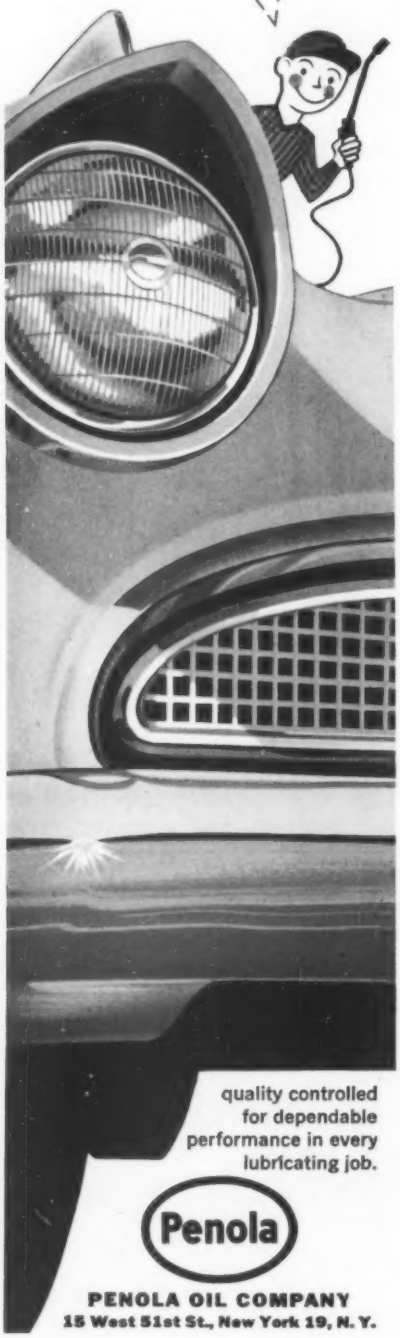
The steering committee is studying a proposal for reorganization of the committees which make up the NLGI Technical Committee set-up. As an example of the changes under consideration, it may be suggested that the Committee on NLGI Classification of Lubricating Greases, which currently limits its activities to questions directly involving that classification, may have its designation and range of responsibility broadened to cover the subject of consistency of lubricating greases.

The NLGI classification would be regarded as one subheading of that broad subject. Similarly, the Committee on Recommended Practices for Packing Automotive Front-Wheel Bearings might be replaced by a new committee which would be responsible for development of recommended practices not only for packing automotive front-wheel bearings but also all other types of bearings where such recommendations are regarded as desirable from an industry-wide viewpoint. Opinions regarding the pros and cons of the proposal should be sent to L. C. Brunstrum, E. W. Nelson, or T. G. Roehner.

A COMPLETE line of stock oils, quickly available to you through strategically located warehouses, terminal facilities, and refineries in 31 states from Maine to New Mexico. Also quality petrolatums.

GULF OIL CORPORATION
2927 GULF BUILDING
PITTSBURGH 30, PA.

for smooth action...
always specify
PENOLA AUTOMOTIVE LUBRICANTS



quality controlled for dependable performance in every lubricating job.

Penola

PENOLA OIL COMPANY
15 West 51st St., New York 19, N. Y.

Mr. Sargent has had many years of experience in the industrial lubrication field. For the past several years he has held important posts with Allied Oil company in Cleveland, an affiliate of Ashland. Prior to his work with Allied, he had spent over fifteen years with National Refining company (also an Ashland affiliate) in various sales posts, including industrial sales manager.

Ritz Promoted at Emery

James W. Ritz has been promoted to the position of assistant sales manager of the organic chemical sales department of Emery Industries, Inc., R. F. Brown, sales manager, has announced.

Mr. Ritz will have direct responsibility for the sales of Emery's lines of plasticizers, lubricant esters, fatty acid esters, azelaic and pelargonic acids, and high-molecular weight polybasic acids.

Succeeds R. T. Hull

He succeeds R. T. Hull, recently named vice-president and general manager of Emery's newly acquired Canadian subsidiary, Emery Industries (Canada) Ltd.

Ritz joined Emery in 1941 as a research chemist. Several years later he transferred to the sales department in the Philadelphia area. In 1949 he was made district manager of that office, and in 1953 was named eastern district manager of Emery's chemical sales department.

A graduate of the University of Cincinnati, Ritz is a member of the American Chemical Society, the American Association of Textile Chemists and Colorists, the Chemical Club of Philadelphia, and the Philadelphia Rubber Group.

Fieglein to Handle Southwest Territory

W. N. Fieglein has been appointed to the southwest sales territory of Emery Industries, Inc., G. W. Boyd, sales manager of Emery's fatty acid sales department announced.

Fieglein will handle Emery's complete line of fatty acids, which includes stearic and oleic acids, animal and vegetable acids, hydrogenated fatty acids and glycerides, and castor oil derivatives.

The southwest territory includes Texas, Oklahoma, Louisiana, Arkansas, Mississippi, southern Kansas, southwestern Missouri, southwestern Alabama, and western Florida.

Fieglein attended the University of Cincinnati and the University of Alabama. He is a member of the National Research Institute and the National Foremen's association. He joined Emery's research department in 1941, and for the last seven years has been a foreman in the production department.

LET US MODERNIZE YOUR PLANT

C. W. NOFSINGER CO.

Petroleum and Chemical Engineers

906 GRAND AVENUE
KANSAS CITY 6, MO.

"In Engineering it's the People that count"

Swift Opens Technical Department

Due to diversification of department's activities, Swift & Company has changed the name of the department previously known as the industrial oil department, to the "technical products department."

Mr. F. E. Lacey, general manager of this section of Swift's operation, announced the change. The scope of the department now encompasses many fields, including industrial chemicals, corrosion inhibitors, esters, animal feed additives, products for the pharmaceutical and cosmetic manufacturers, plasticizers, defoamers, chemicals for the oil industry, all in addition to the standard fatty acid and industrial oil line. Much of the department's volume has just emerged from laboratory to commercial production. The new name will more fully indicate the functions of this department, one of the company's fastest growing units.

Mr. Lacey said the technical products department will function through four main divisions: The fatty acid division, industrial oil division, specialties division, and market development division. Headquarters will remain at 1800 165th Street, Hammond, Indiana.

Du Pont's Sturgis To Advisory Board

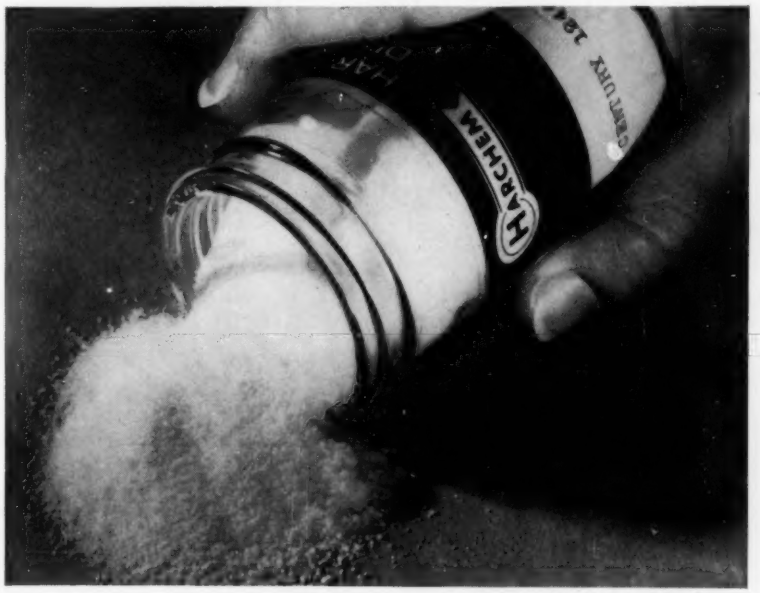
Dr. Bernard M. Sturgis, director of the Du Pont company's petroleum laboratory, Deepwater Point, N. J., has been appointed to the national advisory committee for aeronautics subcommittee for aircraft fuels.

Subcommittees of the NACA assist in initiating research programs, advising upon technical problems, reviewing current research throughout the nation, recommending new areas of research, and coordinating research programs. NACA objectives are to anticipate the research needs of aviation and to supply the armed forces and industry with basic information for the design and production of aircraft.

A. T. McDonald Deceased

The lubrication engineering profession was shocked to hear of the untimely passing of Mr. Allan Thomas McDonald, who died on March 16, 1957, while under anesthesia for minor surgery.

Born July 10, 1901, in Port Arthur, Texas, he obtained his formal education at the University of Texas. Prior to 1951, he was associated with the Caterpillar Tractor company, McMillan Petroleum company, Consolidated Steel corporation, Southern California Gas company, Richfield Oil corporation and Rheem Manufacturing company. For the last six years, he was employed in the standards and materials process section of the aircraft division of Hughes Tool company.



Century Brand Stearic Acid Beads

CENTURY BRAND

beaded fatty acids and glycerides are dust-free

Customers report that they prefer to use Century Brand *beaded* fatty acids and glycerides. Beads do not break during handling or shipment to create nuisance dust that can cause emplcyee discomfort and plant clean-up problems.

Century Brand fatty acids are made in every grade required by industry. The quality of each grade is carefully maintained to assure that no customer will receive off-grade materials. Harchem Division can supply Century Brand fatty acids in any desired quantities at competitive prices.

Ask for a free sample of the Century Brand *beaded* fatty acids suited for your application. Your requests will be answered promptly.

HARCHEM® CENTURY BRAND

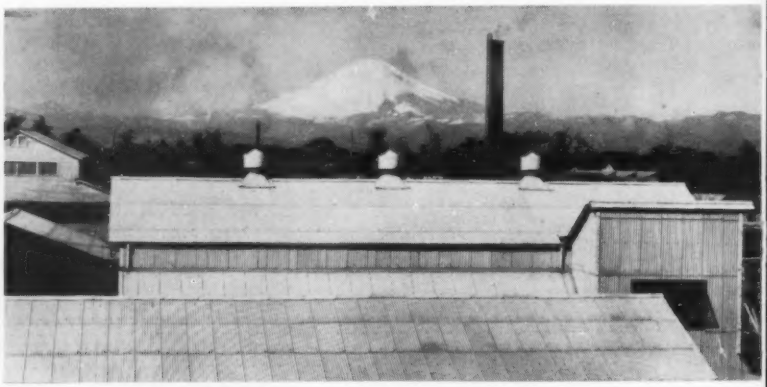
HARCHEM DIVISION
WALLACE & TIERNAN INC.
(SUCCESSOR TO: W. C. HARDESTY CO., INC.)
25 MAIN STREET, BELLEVILLE 9, NEW JERSEY

H-27

Industry NEWS

Kofune Announces Completion of Kyodo Yushi Plant in Tsujido, Japan

LABORATORY in the Kobe factory.



TSUJIDO factory—Mt. Fuji seen from the rooftops of the new plant.

Soshiro Kofune, president of Kyodo Yushi Company, Ltd. in Tokyo announces the completion of the Tsujido factory which is located thirty-two miles away from the city of Tokyo. The April issue of the NLGI SPOKESMAN carried Horton Connell's story and illustrations of the expansion and construction plans which were underway when he visited Kyodo Yushi last August. The new three floor plant was in blueprint form when Connell visited it and now the site has been expanded and another new building erected in February. The first floor of the main plant is for office space and the second entirely for research. It should be noted that the NLGI SPOKESMAN article "Bearing and Grease" by Y. Matsumoto which appeared with Connell's article in the April issue was not translated by L. C. Brunstrum, as stated in that issue.

AP&CC Sets Safety Record

The Trona plant of American Potash & Chemical corporation recently set an all-time record of 2,-

Continued on page 47

FISKE BROTHERS REFINING CO.

Established 1870

★

NEWARK, N. J.

TOLEDO, OHIO

★

Manufacturers of

LUBRICATING GREASES

SWIFT'S INDUSTRIAL OILS

INVITE COMPARISON

Write for a trial order of any of these Swift quality products . . . a trial in your own shop will convince you of their stability and dependability in helping to produce lighter and more uniform lubricants.

SWIFT & COMPANY
INDUSTRIAL OIL DEPT.
1842 165th St.,
Hammond, Indiana

RED OILS • STEARIC ACIDS • LARD OILS • SPERM OILS • TALLOWS • HYDROGENATED CASTOR OILS, GLYCERIDES, & FATTY ACIDS • METHYL #12-HYDROXYSTEARATE • #12-HYDROXYSTEARIC ACID • VEGETABLE FATTY ACIDS • TALLOW FATTY ACIDS • ACIDLESS TALLOWS

Swift

To Serve Your Industry Better

There's only ONE Leader

SOUTHWEST FOR Good GREASE

Increase Your Spring Grease Sales With The

LOAD-A-MATIC PROMOTIONAL PROGRAM!

SUPERIOR LOAD-A-MATIC GREASE GUN

A REALLY NEW, EFFICIENT, EASILY OPERATED, TUBE LOADING GUN

STAR LOAD-A-MATIC GREASE GUN FILLER

THE SPECIAL ONE-PIECE, HEAVY STEEL STAR **LOAD-A-MATIC** GREASE GUN FILLER, FEATURING THE STAR VALVE FITTING FOR EASY, DIRT-FREE ECONOMY GREASE GUN FILLING.

25 35 40 LB

LOAD-A-MATIC GREASE TUBES

ALL NEW AND SPARKLING CLEAN. NO DIRT WITH THE CONVENIENT **LOAD-A-MATIC** GREASE TUBES. CHANCES FOR LUBRICANT CONTAMINATION COMPLETELY ELIMINATED.

PACKED 10 TO A CARTON

LOAD-A-MATIC COUNTER DISPLAY...

"the Silent Salesman that works overtime"

* Available Under Your Brand Name

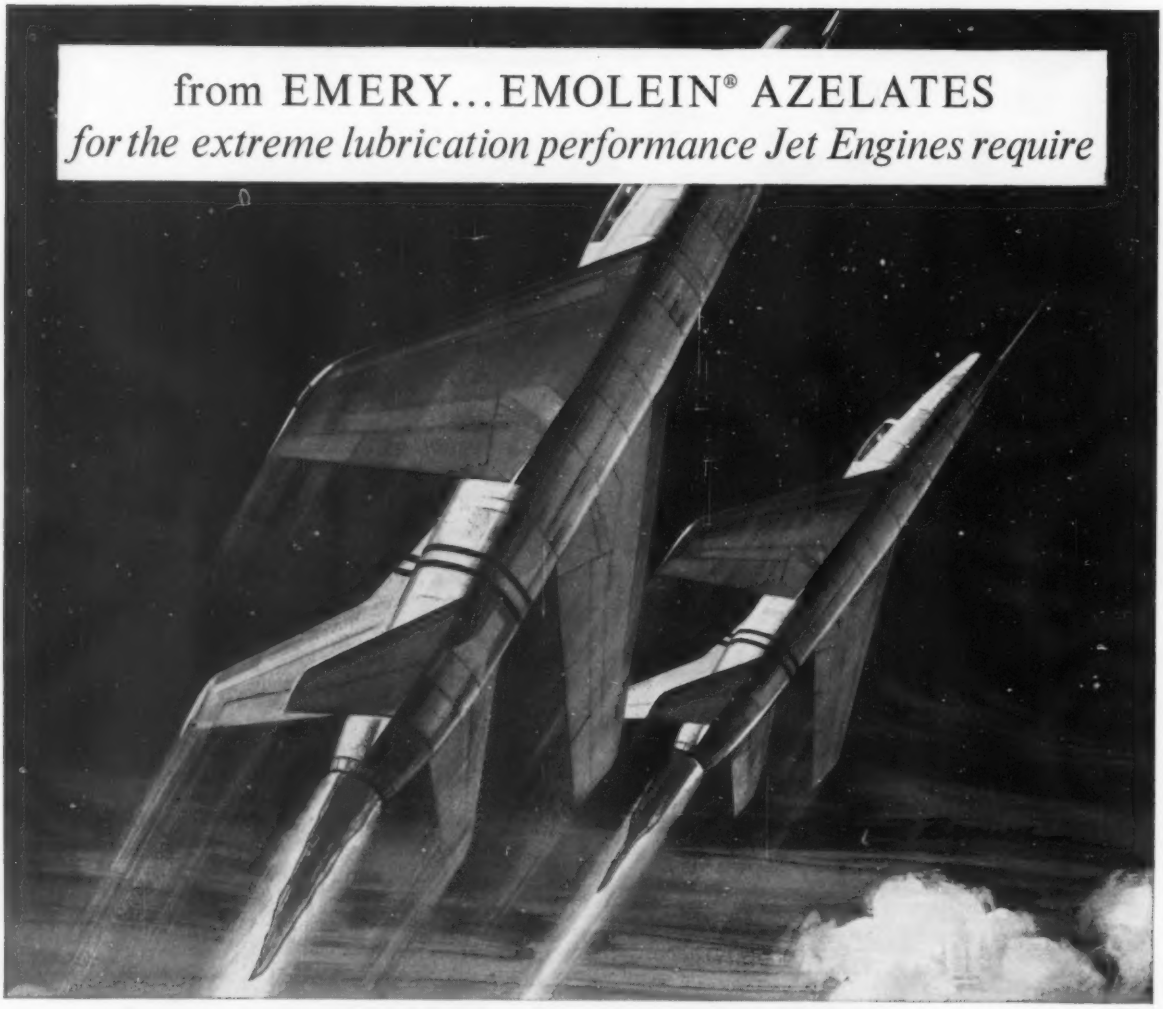
WIRE, WRITE OR TELEPHONE FOR SAMPLES AND FURTHER INFORMATION

SPECIALIZING IN THE CUSTOM MANUFACTURE OF PETROLEUM LUBRICATING GREASES AND SPECIALTIES

SOUTHWEST GREASE & OIL CO., INC.

220-230 WEST WATERMAN • WICHITA 2, KANSAS

from EMERY...EMOLEIN® AZELATES
for the extreme lubrication performance Jet Engines require



MEETS BOTH MILITARY AND CIVILIAN REQUIREMENTS

Synthetic lubricant fluids that meet both military (Mil-L-7808-C) and civilian specifications are now being compounded from Emolein Azelates (diesters).

The excellent performance of these new diesters, Emolein 2957 di-iso-octyl azelate and 2958 di-2-ethylhexyl azelate in lubricants designed to meet the extreme heat and cold performance qualities required by jet engines, is attributed to the following combination of properties:

1) excellent temperature-viscosity performance even at high and low temperature extremes... 2) high viscosity index... 3) low pour points... 4) excellent lubricity... 5) oxidation and corrosion stability... 6) high flash and fire points... 7) excellent additive response.

Produced from non-strategic raw materials

Since the Emolein azelates are based on azelaic acid obtained from domestic fats and oils abundant in supply, availability is not contingent on strategic imported raw materials. Also, future plant expansion is being carefully coordinated with the broadening utility of these diesters.

Application in other synthetic lubricants

Other military specifications met by synthetic fluids and greases compounded from Emolein Azelates include: Mil-G-3278 A, Grease, Aircraft and Instruments-Low and High Temperatures; Mil-L-6085 A, Lubricating Oil, Aircraft Instruments, Low Volatility; and Mil-L-6387 A, Lubricating Oil, Synthetic Base.

Mail coupon below for full technical information.

Emery

Organic Chemical Sales Department

Emery Industries, Inc., Carew Tower, Cincinnati 2, Ohio

Emery Industries, Inc., Dept. E5 Carew Tower Cincinnati 2, Ohio

Please send me a copy of your 16-page Technical Bulletin No. 409 titled "Emolein Esters for Synthetic Lubricants."

Name.....Title.....

Company.....

Address.....

City.....State.....

000,000 man-hours without a lost-time accident.

The safety record, involving more than 850 employees at the company's main plant at Trona, Calif., covered nearly a full year without a lost-time accident.

The plant's previous record of 1,000,000 safe man-hours was set between August and December of 1954, after which AP&CC received the Lammot du Pont safety award for the greatest improvement in safety in the chemical industry.

Since then, AP&CC has received more than ten safety awards as a result of the company's intense safety education program conducted for the past three years.

Socony Mobil Donates Funds To Colleges

Socony Mobil Oil Company, Inc., will contribute a total of $856,000 to further education in the United States in the academic year 1957-1958.

The major portion of the contribution, $650,000, will be in direct grants to universities and colleges as part of the company's continuing program of assistance. It will be distributed as follows: $186,500 for fellowships and scholarships; $181,000 for research grants of various kinds; $43,000 for professorships; $89,500 for miscellaneous grants and $150,000 for privately supported liberal arts institutions. This $150,000 duplicates the company's 1956 contribution to these institutions. It will be distributed through the Association of American Colleges and through two Socony Mobil affiliates, Magnolia Petroleum company in the Southwest and General Petroleum corporation in the far West.

Contributions to schools or individuals do not in any way obligate the recipients to Socony Mobil. Almost all fields of collegiate and graduate study, as well as various other educational projects, are covered by the grants.

"Dag Dispersions" Issued By Acheson Colloids

A new edition of its four-page bulletin, "'dag' Dispersions for Industry," listing 44 colloidal and semi-colloidal dispersions of graphite, molybdenum disulfide, mica, vermiculite, zinc oxide, acetylene black, copper, and glass, has just been issued by Acheson Colloids company, Port Huron, Mich. Carriers and diluents are given for each product, along with typical applications and important physical data.

This is Eighth Revision

Two entirely new "dag" dispersions, composed of glass in isopropyl alcohol, have been added in this, the eighth revision of Acheson's product list. Embodying a new concept in metalworking lubrication, the new glass dispersion, Nos. 239 and 240, provide a protective and lubricating coating for the forging of special alloy steels, titanium and other metals which are particularly subject to oxidation or gas absorption at elevated temperatures during pre-heating and forming.

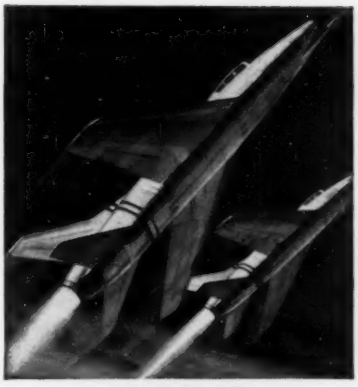
Copies of "'dag' Dispersions for Industry" are available free from Acheson Colloids company, Port Huron, Michigan.

Alpha Molykote Readies Lubrication Newsletter

"Lubrication Newsletter," Volume 1, Number 2, containing a technical paper on the measurement of surface temperatures under sliding friction by a newly developed thin thermocouple technique has been released by the Alpha Molykote corporation.

This technical article discusses in detail the development of a method to measure frictional temperatures in the contact area of the surface. Following the theoretical discussion is a description of the test set-up and the experimental procedure and results. Charts

Continued on page 48



NEW...
EMERY 3033-S
LUBRICANT ESTER...

a new-type diester base for synthetic lubricants

Emery 3033-S is a new-type dipropylene glycol diester based on pelargonic acid, a unique, C_9, saturated, monobasic acid.

It is currently in use or under test in the following three areas: 1) Synthetic greases for spec. Mil-G-3278-A Low Temperature Aircraft Grease; 2) Low-cost blending component for synthetic low-temperature lubricating fluids meeting Mil-L-7808 C; and 3) synthetic lubricant base fluid for civilian lubricants in aircraft, automotive and specialty uses.

Since 3033-S is based on a relatively low-cost acid, pelargonic acid, long-range economics are favorable. Also, availability is not contingent on strategic, imported raw materials since pelargonic acid is made from abundantly available domestic fats and oils.

Though 3033-S is in a development stage, it is available in tankcar quantities on reasonable notice.

Mail coupon below for Technical Bulletin titled "Emery 3033-S Lubricant Ester" for complete characteristics and performance data in synthetic greases and fluids.

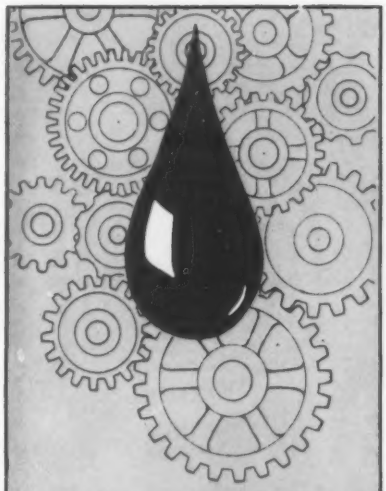
Emery

Development and Service Department
Emery Industries, Inc.
Carew Tower, Cincinnati 2, Ohio

Emery Industries, Inc.
Dept. E5A Carew Tower
Cincinnati 2, Ohio

Please send Development Product Bulletin #60 on Emery 3033-S.

Name.....
Company.....
Address.....
City.....State.....



CUSTOM-MADE
TO YOUR
SPECIFICATIONS!

LUBRICANTS
and COMPOUNDS

American Lubricants is an independent wholesale producer of industrial and automotive lubricants with new, modern, enlarged facilities to manufacture and package your products.

AMERICAN
LUBRICANTS
INC.
Independent Wholesale and Industrial Producers
1575 CLINTON ST.,
BUFFALO 6, N. Y.
Since 1922

showing the relationship between temperature rise and time are included in the newsletter. Test results are compared with theory, arriving at a series of conclusions which describe the need for lubricant testing machines designed and equipped to supply accurate test data as well as allowing full control of all test variables . . . velocity, load, friction force and friction temperatures.

An introduction to the technical paper outlines the problems which exist in lubricant effectiveness evaluation because of the lack of suitable testing equipment and describes steps which have already been taken to provide a universal extreme pressure lubricant testing machine.

Copies of the newsletter may be obtained by writing to the Alpha Molykote corporation, 65 Harvard Avenue, Stamford, Connecticut.

American Potash Produces New Boron Chemicals

American Potash & Chemical corporation announces the production of two new boron chemicals—boron trichloride and boron tribromide—at its Los Angeles plant. The announcement marks the first time boron tribromide has been produced on a commercial level.

Cost of boron trichloride in tonnage quantities will be at $1.60 per pound as contrasted to the present market price of $3.00 per pound, according to Daniel S. Dinsmoor, AP&CC vice president for planning and development.

Dinsmoor said the reduced price was made possible by a semi-continuous production process developed recently by AP&CC's research department. Dinsmoor said also that further price reductions are anticipated as production volume increases.

Boron trichloride, a gas, and boron tribromide, a liquid, can be used in producing elemental boron and as intermediates or raw materials for the manufacture of other boron compounds such as diborane and sodiumborohydride. Also they can be utilized in halogenation reactions and as catalysts in certain processes. In addition, boron trichloride is suitable as a fire extinguishing agent for magnesium fires.

Announcement of the two new products raises to approximately 30 the number of boron chemicals being manufactured by American Potash & Chemical Corporation as a part of its long-range program of boron research and development.

Five Year Lube Guarantee Offered by Alemite

Five years of protection against repair bills on lubricated parts will be given by the Alemite Division of Stewart-Warner corporation. The plan is being handled through au-

Continued on page 50

DARLING'S

FATTY ACIDS
ESPECIALLY FOR
GREASE MAKERS

STEARIC ACID
OLEIC ACID
RED OIL
HYDROGENATED FATTY ACIDS
HYDROGENATED GLYCERIDES
GLYCERINE
STEARINE PITCH

DARLING & COMPANY
4200 S. ASHLAND AVE.
CHICAGO 9, ILL.

NLGI Associate, Technical Members

CONTAINER AND CLOSURE MANUFACTURERS

American Can Company
4810 Belleview, Kansas City 12, Mo.
Representative—H. T. Rich

American Flange & Manufacturing Company, Inc.
30 Rockefeller Plaza, New York 20, N. Y.
Representative—Richard L. Parish, Jr.

Bennett Industries
Peotone, Illinois
Representative—S. A. Bennett

Central Can Company
2415 West 19th St., Chicago 8, Illinois
Representative—Henry Frazin

Continental Can Company, Inc.
100 East 42nd St., New York 17, N. Y.
Representative—W. J. Flint

Geuder, Paeschke & Frey Company
324 North Fifteenth St., Milwaukee 1, Wis.
Representative—Neil Savee

Inland Steel Container Company
6532 South Menard Ave., Chicago 38, Ill.
Representative—J. Daniel Ray

Jones & Laughlin Steel Corporation
Container Division
405 Lexington Ave., New York 17, N. Y.
Representative—C. K. Hubbard

National Steel Container Corp.
6700 South LeClaire Ave., Chicago 38, Ill.
Representative—Henry Rudy

The Ohio Corrugating Company
917 Roanoke Ave. S. E., Warren, Ohio
Representative—Lawrence F. McKay

Republic Steel Corporation
Container Division
465 Walnut Street, Niles, Ohio
Representative—Theodore Humphrey

Rheem Manufacturing Company
477 Madison Ave., New York 22, New York
Representative—F. J. Blume

Rieke Metal Products Corporation
Auburn, Indiana
Representative—Mahlon E. Rieke

Steel Package Division of National Lead Company
722 Chestnut Street, St. Louis 1, Missouri
Representative—Warren T. Trask

United States Steel Products
Division, United States Steel Corporation
30 Rockefeller Plaza, New York 20, N.Y.
Representative—Wm. I. Hanrahan

Vulcan Containers, Inc.
P. O. Box 161, Bellwood, Illinois
Representative—H. B. Scharbach

ENGINEERING SERVICES

The C. W. Nofsinger Company
906 Grand Ave., Kansas City 6, Missouri
Representative—C. W. Nofsinger

MANUFACTURERS OF EQUIPMENT FOR APPLICATION OF LUBRICATING GREASES

Aro Equipment Corporation
Bryan, Ohio
Representative—D. G. Reed

Balcrank, Inc.
Disney near Marburg, Cincinnati 9, Ohio
Representative—Richard P. Field

Gray Company, Inc.
60 Northeast 11th Ave., Minneapolis 13, Minn.
Representative—B. A. Beaver

Lincoln Engineering Company
5701 Natural Bridge Ave., St. Louis 20, Mo.
Representative—G. A. Hubbard

Stewart-Warner Corporation
Alemite Division
1826 Diversey Parkway, Chicago 14, Illinois
Representative—E. G. Wicklatz

Trabon Engineering Corp.
28815 Aurora Rd., Solon, Ohio
Representative—E. W. Baumgardner

MARKETING ORGANIZATIONS

Ampol Petroleum, Ltd.
Buchanan Street
Balmain, New South Wales, Australia
Representative—Wilfred Gordan Askins

California-Texas Oil Company
380 Madison Ave., New York 17, New York
Representative—Hal U. Fisher

Canadian Petrofina Limited
505 Dorchester Street West
Montreal, Quebec, Canada
Representative—M. E. Wight

Cooperative GLF Exchange, Inc.
Terrace Hill, Ithaca, N. Y.
Representative—W. S. Miller

Denco Petroleum Company
5115 Denison Avenue, Cleveland 2, Ohio
Representative—I. L. Carmichael

D-X Sunray Oil Company
Mid-Continent Bldg., P.O.Box 381, Tulsa, Okla.
Representative—J. W. Basore

Farmer's Union Central Exch., Inc.
P. O. Box G, St. Paul 1, Minnesota
Representative—H. F. Wagner

Illinois Farm Supply Company
100 East Ohio Street, Chicago, Illinois
Representative—S. F. Graham

Ohio Farm Bureau Cooperative Association, Inc.
245 North High Street, Columbus 16, Ohio
Representative—Walter N. Callahan

Valvoline Oil Company
Division of Ashland Oil & Refining Co. Box G
Freedom, Pennsylvania
Representative—D. A. Smith

SUPPLIERS OF EQUIPMENT FOR MANUFACTURING LUBRICATING GREASES

Barrett Manufacturing Company
P. O. Box 8096, Houston 4, Texas
Representative—George J. Barrett, Jr.

Chemicolloid Laboratories, Inc.
55 Herricks Road, Garden City Park, N. Y.
Representative—David F. O'keefe

The Farval Corporation
3249 East 80th St., Cleveland, Ohio
Representative—Lee Witzenburg

The Girdler Company
A Div. of National Cylinder Gas Co. Box 987
Louisville 1, Kentucky
Representative—J. E. Slaughter, Jr.

Manton-Gaulin Mfg. Co., Inc.
44 Garden Street
Everett 49, Massachusetts
Representative—G. W. Eldridge

Morehouse-Cowles, Inc.
1152 San Fernando Rd., Los Angeles, Calif.
Representative—George E. Missbach

Stratford Engineering Corporation
612 W. 47th Street, Kansas City 12, Missouri
Representative—D. H. Putney

Struthers Wells Corp.
1003 Pennsylvania Ave. West, Warren, Pa.
Representative—K. G. Timm

SUPPLIERS OF MATERIALS FOR MANUFACTURING LUBRICATING GREASES

Acme-Hardesty Company
60 East 42nd St., New York 17, N. Y.
Representative—W. C. Hardesty

American Cyanamid Company
30 Rockefeller Plaza, New York 20, N. Y.
Representative—B. H. Loper

American Potash & Chemical Corp.
99 Park Avenue, New York 16, N. Y.
Representative—W. F. O'Brien

Archer-Daniels-Midland Company
Chemical Products Division
P. O. Box 839, Minneapolis 2, Minn.
Representative—Frank C. Haas

Armour & Co., Chemical Division
1355 West 31st St., Chicago 9, Illinois
Representative—W. L. Riegler

The Baker Castor Oil Company
120 Broadway, New York 5, New York
Representative—J. W. Hayes

Godfrey L. Cabot, Inc.
77 Franklin Street
Boston 10, Mass.
Representative—H. P. Donohue, Jr.

Climax Molybdenum Company
500 Fifth Ave., New York 36, New York
Representative—Elwin E. Smith

Darling & Company
4201 South Ashland Ave., Chicago 9, Illinois
Representative—G. W. Trainor

E. I. du Pont de Nemours & Co.
Wilmington, Delaware
Representative—R. O. Bender

The Elco Lubricant Corporation
Jennings Road & Denison Avenue
Cleveland 9, Ohio
Representative—Frank X. Sieloff

Emery Industries, Inc.
4300 Carew Tower, Cincinnati 2, Ohio
Representative—G. W. Boyd

Enjay Company, Inc.
15 West 51st St., New York 19, New York
Representative—Sidney W. Fay

Foote Mineral Company
18 W. Chelten Ave., Philadelphia 44, Penn.
Representative—W. F. Luckenbach

Alemite Lube Guarantee

Continued from page 48

tomobile dealers and guarantee is for five years regardless of the mileage driven.

Two developments have made the liberal provisions of the new Alemite plan possible, according to an Alemite official. They are:

"... First, our lubricants have been constantly improved, 'beefed up' to provide wider margins of safety and protection under increasingly severe operating conditions.

"Second, the car manufacturers have constantly improved their products, and their dealers have improved their lubrication and service abilities and facilities.

"All of these improvements, in combination, spell better service for the new car buyer who takes advantage of the new Alemite Five-Year guarantee," he said.

Under terms of the plan lubricated motor parts, chassis and transmission and differential parts which fail in service due to faulty lubrication will be replaced by Alemite.

Warren Claims Lubricating Grease History Is Made

What the manufacturers call a new, "miracle" lubricant, has just been announced by the Warren Refining and Chemical company of Cleveland, Ohio.

During a year of laboratory and field testing, cost-conscious industrial managers have found the new lubricant lasts four times as long as standard open-gear greases.

25% Less Lubricant Required

Only 25% of the new lubricant, called Plastigear-X, is required as compared to even the toughest greases previously used. The new product was developed as a companion to the company's first non-melting, non-freezing, non-soluble lubricant.

Cannot Melt or Freeze

According to Warren people, Plastigear-X presents a tremendous advantage over other lubricants because it cannot melt or freeze, and is not susceptible to water or extreme pressure. At high temperatures it can be successfully used where other open gear lubricants will melt and drip off.

Similarly, it demonstrates its versatility at low temperatures. Because of its low pour point, high viscosity index base oil, it can be used at sub-freezing temperatures where conventional open gear lubricants either chip off or channel out.

Added to these inherent properties, Plastigear-X forms a protective film which has extreme metal adhesiveness and long life.

Plastigear-X is made of highly refined mineral oil bases along with special extreme-pressure agents to give it greater adhesiveness and to enable it to withstand heavy shock loads.

Warren experts state that these extreme-pressure agents, powders perfected by several years of laboratory research and correlated with a basic program of research independently conducted for approximately four years at the Mellon Institute of Pittsburgh, are 100% solid lubricants processed to remain in permanent suspension.

Under pressure these solid lubricants are carried into gear faces and moving surfaces. All score marks, pits, grooves or other facial imperfections are filled and a uniform low friction coating formed. Shock and noise are reduced. Uneven wear is prevented.

Plastigear-X can be applied either by hand or gun. It is recommended for all types of open gears, exposed or enclosed chain, wire rope or cable. Its use in road machinery, manufacturing plants, and all other places requiring open-geared equipment is unlimited.

Its unique properties and extreme economy make Plastigear a valuable maintenance accessory in virtually all phases of industrial production, Warren men say.

Almost everything that moves either in actual operation or in the process of its making . . . from gate hinges to tractor wheels . . . depends upon grease. That is why lubricants should be bought with care. You can always depend upon Deep Rock highest quality greases and lubricants. They are manufactured to give top lubrication to all moving parts.

DEEP ROCK

DEEP ROCK DIVISION
KERR-McGEE OIL INDUSTRIES, INC.
306 N. ROBINSON · OKLAHOMA CITY
PHONE RE 9-0611

CONSTANT

SEARCH for BETTER LUBRICANTS by DENCO

ASSURES QUALITY IN YOUR PACKAGE

The same "Know-How" that makes Denco the first in the manufacture of bentone lubricants, is used in everyday production of Denco's complete line of greases, oils, and compounds for every lubricating and metal-working function. A "Know-How" that's backed by fifty years of experience.

We will produce to your specifications, package, label, and ship according to your instructions.

Call OL. 1-6600 or write today

DENCO PETROLEUM CO.
5115 Denison Ave.
CLEVELAND 2, OHIO

NLGI Associate, Technical Members

A. Gross and Company
295 Madison Avenue, New York 17, N. Y.
Representative—Eugene W. Adams

The C. P. Hall Company of Illinois
5145 West 67th St., Chicago 38, Illinois
Representative—J. E. Stonis

Harchem Division
Wallace & Tiernan, Inc.
25 Main St., Belleville, N. J.
Representative—W. G. McLeod

The Humko Co. Chemical Division
P. O. Box 4607, 1702 N. Thomas St.
Memphis, Tennessee
Representative—W. J. O'Connell

Lithium Corporation of America, Inc.
Rand Tower, Minneapolis 2, Minnesota
Representative—Walter M. Fenton

The Lubrizol Corporation
Box 3057—Euclid Station, Cleveland 17, Ohio
Representative—J. L. Palmer

Mallinckrodt Chemical Works
2nd & Mallinckrodt Sts., St. Louis 7, Missouri
Representative—D. B. Batchelor

N. I. Malmstrom & Company
147 Lombardy St., Brooklyn 22, New York
Representative—Ivar Wm. Malmstrom

The McGean Chemical Corp.
Midland Building, 101 Prospect Ave., N. W.
Cleveland 15, Ohio
Representative—W. A. Ritchie

Metasap Chemical Corporation
Harrison, New Jersey
Representative—O. F. Lohrke

Monsanto Chemical Company
800 North Twelfth Blvd., St. Louis 1, Mo.
Representative—J. W. Newcombe

National Lead Company
Baroid Sales Div., 111 Broadway, N.Y. 5, N.Y.
Representative—H. H. Farnham

Newridge Chemical Company
7025 West 66th Place, Chicago 38, Illinois
Representative—T. E. Shine

M. W. Parsons—Plymouth, Inc.
59 Beekman St., New York City 38, New York
Representative—Herbert Bye

Synthetic Products Company
1636 Wayside Rd., Cleveland 12, Ohio
Representative—Garry B. Curtiss

Swift & Company
165th & Indianapolis Blvd., Hammond, Ind.
Representative—F. H. Beneker

Vegetable Oil Products Co., Inc.
Vopcolene Division
5568 East 61st Street, Los Angeles 22, Calif.
Representative—C. F. Williams

Witco Chemical Company
6200 West 51st St., Chicago 38, Ill.
Representative—E. F. Wagner

TECHNICAL AND RESEARCH ORGANIZATIONS

American Lithium Institute, Inc.
P. O. Box 549, 84 Nassau St.
Princeton, New Jersey
Representative—Marshall Sittig

Battelle Memorial Institute
505 King Avenue, Columbus 1, Ohio
Representative—S. L. Cosgrove

Inland Testing Laboratories
6401 Oakton St., Morton Grove, Ill.
Representative—Dr. Morton Fainman

Institut Francais du Petrole
CMrR—Courtel, 4 Place Bir Hackeim
Rueil—Malmaison (S. et Oise) France

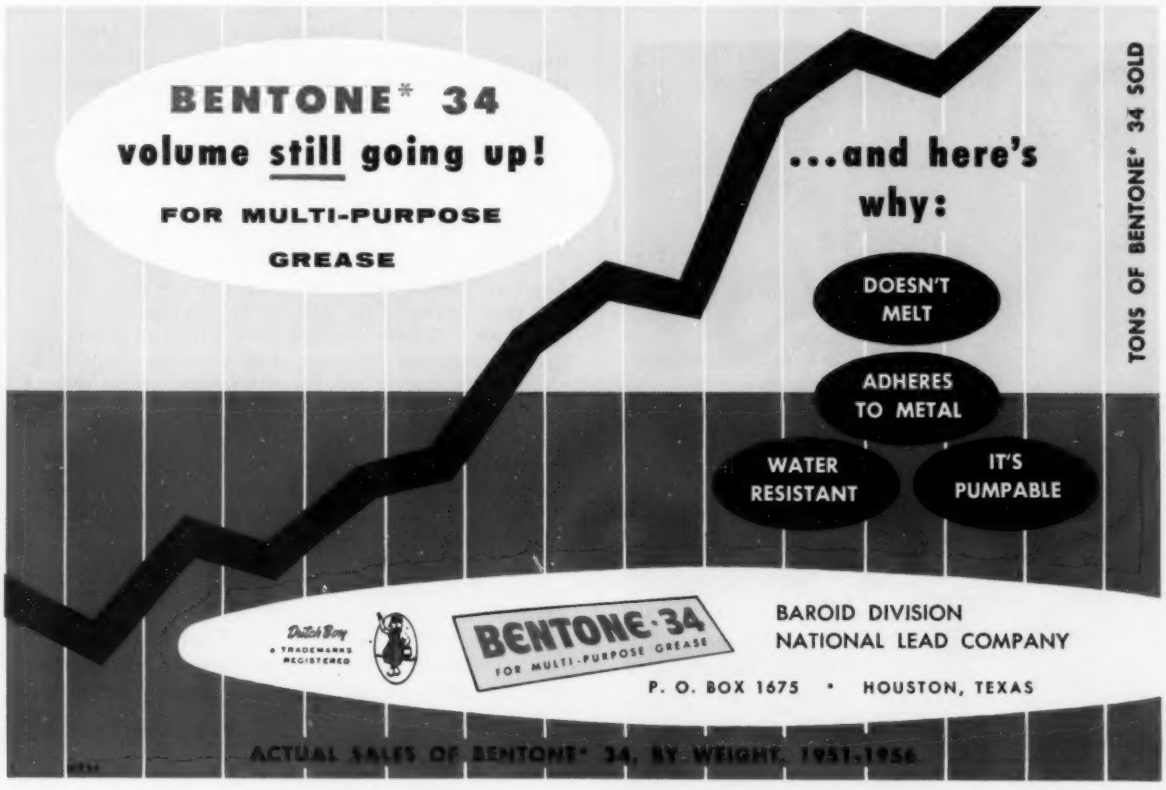
Les Laboratoires de Recherches Purfina
98/100 Chaussee de Vilvorde,
Bruxelles, Belgium
Representative—R. Gillerot

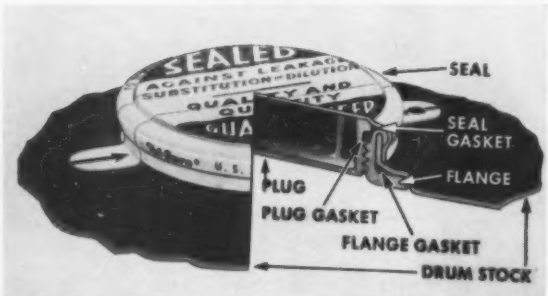
National Rosin Oil Products, Inc.
1270 Ave. of the Americas, N.Y. City 20, N.Y.
Representative—Richard Bender

Petroleum Educational Institute
9020 Melrose Avenue, Los Angeles 46, Calif.
Representative—G. A. Zamboni

Phoenix Chemical Laboratory, Inc.
3953 W. Shakespeare Ave., Chicago 47, Ill.
Representative—Mrs. G. A. Krawetz

Products Development Laboratory
1 Market St., West Warwick, Rhode Island
Representative—Alberic T. DiMasi





In announcing the affiliation of the American Flange & Manufacturing Co. Inc. with NLGI, we welcome to membership one of the pioneer developers and manufacturers of closures for drums and pails.

Back in 1919 R. L. Parish started to supply welded flanges to the drum industry. These, as manufactured by him and others, were the accepted closure flanges for drums at that time. They were made to receive old-fashioned bungs, with flat gasket seats, carrying leather gaskets. For this purpose, the oil companies had people out buying select hides.

The gasket surfaces of the flanges were often warped by welding, making their closing imperfect. Leakage and undetected pilferage were commonplace, and the loss of 10% of the container's contents was normally accepted.

Mr. Parish concentrated on this problem, and in 1921 started the production of American pressed-in flanges. These flanges provided a truly flat seat for the plug gasket and made the insertion of flanges easier and more economical. In 1922, Mr. Parish, founded the American Flange & Manufacturing Co. Inc., of which he became president.

New Member

nlgi

In 1927 American Flange took the next important step in the improvement of closures by the introduction of its tamper-proof seal. This seal covered the plug or bung so that undetected tampering of the drum contents was eliminated. The problem of leakage was not yet fully solved, so research and development work, in materials and structures was continued to evolve a closure that would effect truly comprehensive protection for the liquid contents of containers.

These efforts resulted in the development of the Tri-Sure closure—introduced in 1932—which, for the first time provided the petroleum and chemical industries with a closure that not only gave full protection from undetected pilferage, but was also fully leakproof. This closure was the forerunner of the refined and improved Tri-Sure closure of today.

The Tri-Sure closure is composed of a flange, plug and seal—all gasketed—which interengage to provide a margin of safety from internal and external pressure, breathing in, leakage and seepage, and surpasses the requirements of the average container.

The plants of all drum manufacturers throughout the world are equipped with dies for the insertion of Tri-Sure flanges. In addition, many of them employ special insertion machinery developed by American Flange. Capseals, which can be obtained lithographed with the user's private design, are applied by special

hand and power operated sealing tools, designed, furnished and serviced by American Flange and its affiliates throughout the world.

The company makes coated flanges and plugs, as well as polythene plugs for use with lined containers. An important development in this field is polygonal neck flange, particularly useful for lined containers and for maintaining the continuity of the lining. This flange is also completely enclosed in a polythene overlay.

In addition to drum closures, the company manufactures an extensive line of nozzles, spouts, seals and caps for light containers, including coated spouts and nozzles, and polythene spouts.

One of the most important developments in recent years in closures for pails and cans is the company's reversible spout assembly, which has been received in the industry with great enthusiasm and which is now widely used by pail shippers. In this assembly, the spout is protected inside the pail during the shipment, and then is easily reversed for pouring.

American Flange Joins NLGI

For users who prefer a rigid spout, Tri-Sure offers the well-known KT and utility can closures, which are the old reliable among can and pail fittings. These closures are a great favorite among sportsmen, home gardeners, contractors, etc. because they not only facilitate pouring but make cans easy to re-use.

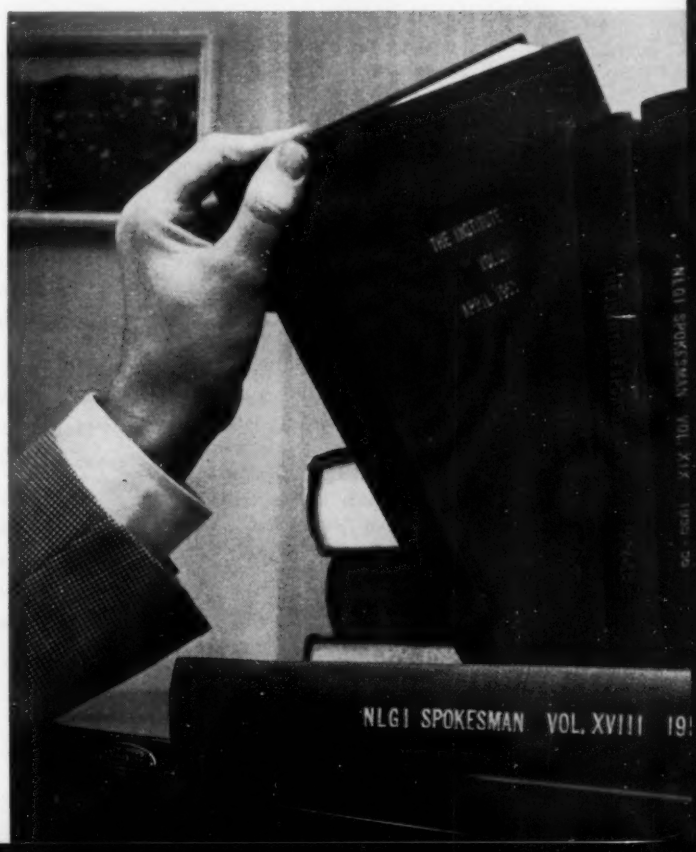
Among their other pail assemblies is the push-pull, which has a spout and nozzle assembled, with the nozzle clinched to the cover of the pail. The spout can be pulled out for pouring or pressed down below the rim of the nozzle and suspended inside the pail. The tru-pour assembly, featuring a collapsible spout, is another unique closure for pails. The spout can be readily extended for pouring and just as readily collapsed into the nozzle so that the pail can be easily stacked.

American Flange, with general offices in New York, now has seven plants—at Chicago, Illinois; Linden, New Jersey; Niles, Ohio; St. Catharines, Ontario; Sao Paulo, Brazil; Villawood, N. S. W., Australia; and Naucalpan, Mexico, as well as affiliates in London, England and Amsterdam, Holland. This world-wide set-up—which is publicized as "Tri-Sure the World Over"—is suplemented by a large staff of sales engineers strategically located to serve customers.

Officers of the company are R. L. Parish, president; John Myers, secretary; Richard L. Parish, Jr., vice president in charge of sales; L. Robert Vitkin, vice president in charge of production.

NLGI SPOKESMAN INDEX

A COMPILATION OF FIVE years, the NLGI *Spokesman* . . . from Volume XV through Volume XX, April 1952 through March 1957, containing authors, titles and classifications indexed by Industrial Arts index and Chemical Abstracts. Complimentary copies of this index are available to all subscribers of the journal of the National Lubricating Grease Institute . . . merely write to NLGI's national office and the index will be mailed immediately.



Bound Volume XX Released

The latest bound volume of NLGI SPOKESMAN back issues is now available and for sale from the national office . . . Volume XX contains more than 30 technical features and matches preceding books in its attractive and rugged green binding, complete with gold lettering. A copy of Volume XX costs $7.00 (NLGI member) and $10.00 (non-member), plus postage.

New French Member

Another new member has affiliated with the National Lubricating Grease Institute . . . Compagnie Francaise de Raffinage in Paris, France is now an NLGI Technical member. Veteran petroleum consultant Albert E. Miller of Westfield, New Jersey is the French firm's American representative and he will act as NLGI company representative. A technical representative will be named at a later date.

Reprints of Technical Articles

Reprint orders totalling more than 25,000 booklets and pamphlets have been delivered since the first of the year . . . these are composed of technical and marketing features presented in recent issues of the NLGI SPOKESMAN. Because page forms are left standing three months after an issue has been run a reprint order can be had at very little cost . . . as low as ten cents a copy. Many firms have advertising included on their material and distribute these pieces throughout their corporation or to customers. Any quantity orders are accepted.

Spokesman Index Ready

The NLGI SPOKESMAN index has been distributed to all members and is available on a complimentary basis to subscribers desiring it. The material is indexed by Industrial Arts index and Chemical Abstracts, and covers technical features presented for the past five years . . . Volume XV through Volume XX.

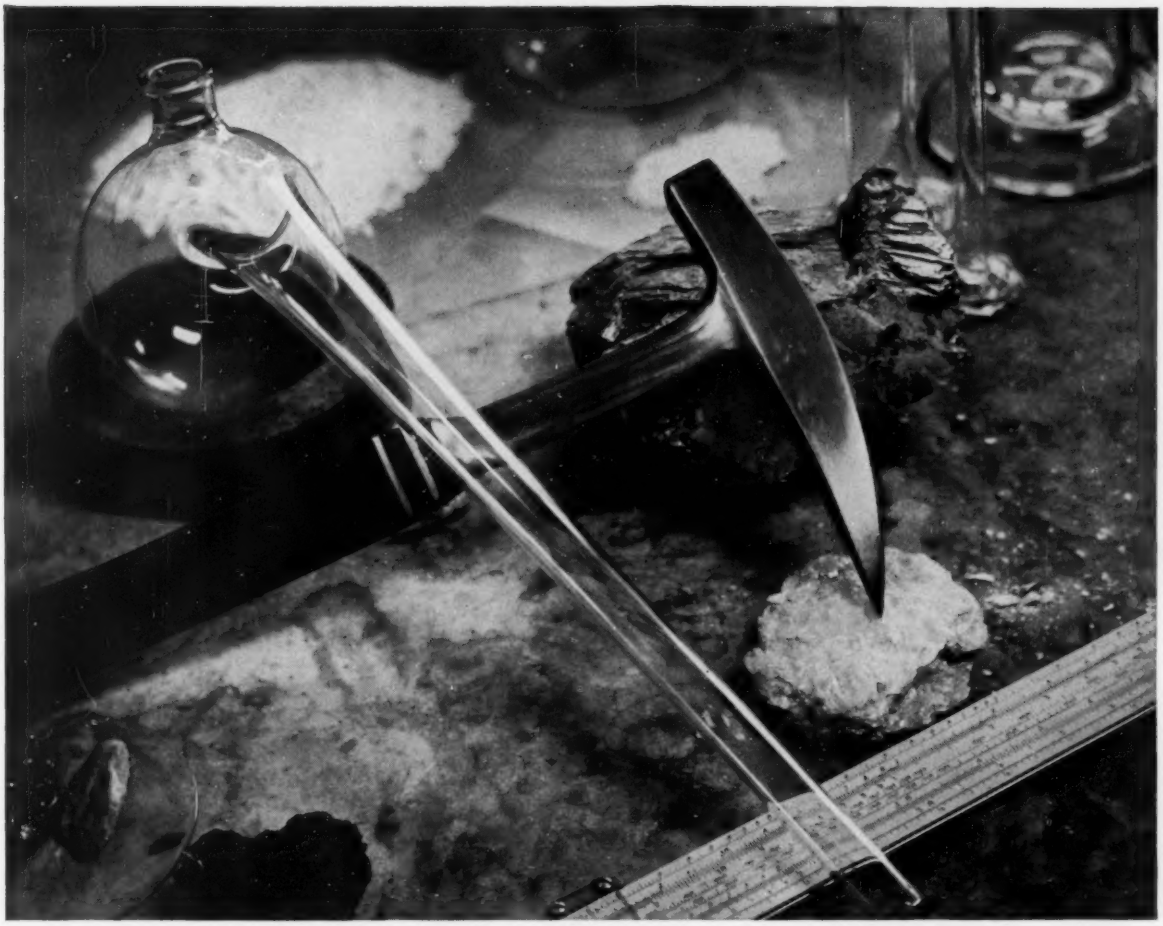
NLGI Board Meets At Point Clear

The Board of Directors of NLGI will meet at Point Clear, Alabama on May 8, for the regular quarterly business session. This will be held following the meeting of the API lubrication committee at Point Clear.

SERVICE AIDS

Send Orders to: National Lubricating Grease Institute, 4638 Nichols Parkway, Kansas City, Mo.

- **REPRINTS – From the NLGI SPOKESMAN are available at low cost. Page forms are left standing for three months, company imprint or advertising arranged.**
- **VOLUME XX—Bound volume of the NLGI SPOKESMAN from April, 1956 through March, 1957. An excellent reference source, sturdily bound in a handsome green cover . . . $7.00 (NLGI member price) and $10.00 (non-member) plus postage.**
- **NLGI MOVIE—"Grease, the Magic Film," a 16-mm sound movie in color running about 25 minutes, to be released in October, 1957. First print $600, second print $400, third and subsequent orders $200 each (non-members add $100 to each price bracket).**
- **WHEEL BEARING MANUAL—"Recommended Practices for Lubricating Automotive Front Wheel Bearings." More than 90,000 copies of this booklet have been distributed throughout the world. Fifteen cents a copy (NLGI member price) with quantity discounts – company imprint arranged.**
- **BONER'S BOOK—Manufacture and Application of Lubricating Greases, by C. J. Boner. This giant, 982-page book with 23 chapters dealing with every phase of lubricating greases is a must for everyone who uses, manufactures or sells grease lubricants. A great deal of practical value. $18.50, prepaid.**



THE HAMMER AND THE RETORT

As the geologist's hammer signifies the mineral wealth locked in the earth's crust, the chemical retort signifies the power to free that wealth for the benefit of mankind. Together, the hammer and the retort symbolize the marriage of geology and chemistry that is the tradition and the future of the Foote Mineral Company.

Founded eighty years ago as a supplier of mineral products, Foote has expanded constantly, until now its business includes mining, mineral and alloy processing, chemicals, and metals. And the pioneering done by the company in the extraction and application of many lesser known elements has contributed substantially to many important technological advances.

Foote Mineral Co., 402 Eighteen West Chelten Bldg., Philadelphia 44, Pennsylvania.

Foote
MINERAL COMPANY

RESEARCH LABORATORIES: Berwyn, Pennsylvania

PLANTS: *Cold River, N.H.; Exton, Pa.; Kings Mountain, N.C.; Knoxville, Tenn.; Sunbright, Va.*

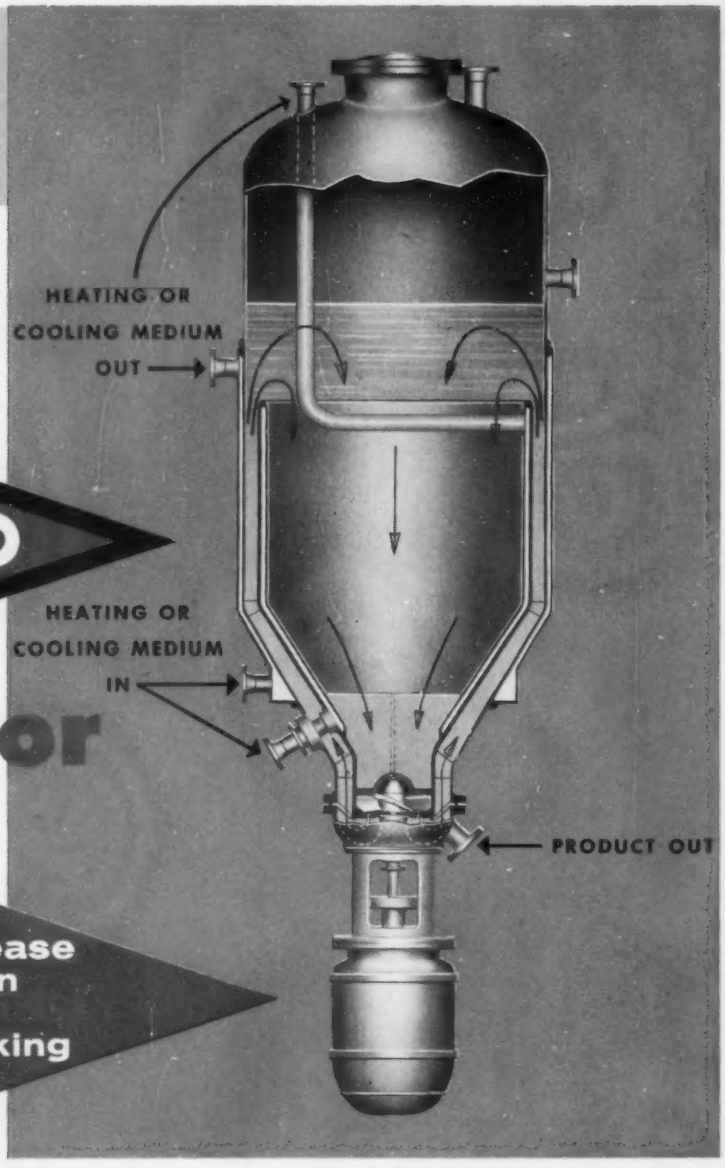
LITHIUM CHEMICALS, MINERALS, METALS • STRONTIUM CHEMICALS • ELECTROLYTIC MANGANESE METAL • WELDING GRADE FERRO ALLOYS • STEEL ADDITIVES • COMMERCIAL MINERALS AND ORES • ZIRCONIUM, TITANIUM, HAFNIUM (IODIDE PROCESS)

a

STRATCO

Reg. U.S. Pat. Off.

contactor



- **Will Simplify Your Grease Plant Operation**
- **Reduce Your Grease Making Costs**

The Stratco Contactor provides complete saponification of all soaps with very short time cycles and with resulting less soap requirement, simplified laboratory control and reduced man hours of operation.

It can be used for either batch or continuous mixing. It is adaptable to existing plants as basic equipment in a modernization program, or to completely new installations as a vital and money saving unit, regardless of other equipment used.

This contactor also is employed advantageously in clay contacting and in sulphurization of cutting oils. It is available in capacities from 2 gallon laboratory units to 2300 gallon commercial sizes.

STRATFORD ENGINEERING Corporation

612 West 47th St. — *PETROLEUM REFINING ENGINEERS* — Kansas City 12, Mo.